A REVISION OF THE GENUS *CATOPTROPTERYX* KARSCH (ORTHOPTERA : TETTIGONIIDAE)

BY

JOHN HUXLEY

British Museum (Natural History)

Pp. 127–170; 1 *Plate*, 95 *Text-figures*

BULLETIN OF
THE BRITISH MUSEUM (NATURAL HISTORY)
ENTOMOLOGY Vol. 24 No. 5
LONDON : 1970

THE BULLETIN OF THE BRITISH MUSEUM (NATURAL HISTORY), *instituted in* 1949, *is issued in five series corresponding to the Departments of the Museum, and an Historical series.*

Parts will appear at irregular intervals as they become ready. Volumes will contain about three or four hundred pages, and will not necessarily be completed within one calendar year.

In 1965 *a separate supplementary series of longer papers was instituted, numbered serially for each Department.*

This paper is Vol. 24 *No.* 5 *of the Entomological series. The abbreviated titles of periodicals cited follow those of the World List of Scientific Periodicals.*

World List abbreviation
Bull. Br. Mus. nat. Hist. (Ent.).

TRUSTEES OF
THE BRITISH MUSEUM (NATURAL HISTORY)

Issued 30 *January,* 1970

Price £1 10*s.*
(£1·50)

A REVISION OF THE GENUS *CATOPTROPTERYX* KARSCH (ORTHOPTERA : TETTIGONIIDAE)

By JOHN HUXLEY

CONTENTS

SYNOPSIS

The African genus *Catoptropteryx* Karsch is fully revised and a key is given to the species. Three specific synonyms are newly established and seven new species are described.

INTRODUCTION

KARSCH erected the genus *Catoptropteryx* in 1890 for a single new species, *C. guttatipes*, from Cameroon. In 1896 he described a further six new species and suggested that closely related to these were three of the four African species described in *Caedicia* Stål, of which, however, he formally transferred only *Catoptropteryx afra* (Karsch). Kirby, in his catalogue of 1906, listed eleven species of *Catoptropteryx* Karsch and included all the African species of *Caedicia* Stål. No new species has been recorded since 1896, with the exception of *C. latipennis* Chopard, 1955, which is considered here to belong to another genus (see below). Although up to the present time the genus *Catoptropteryx* Karsch has been remarkably homogeneous and easily recognized, there has always been considerable difficulty in the separation of the species. The present work, while attempting to remove this difficulty, inevitably extends the morphological and geographic boundaries of the group, making it more heterogeneous and less readily characterized. Over 1200 specimens have been examined, including all the type material. Seven new species are described, three specific synonyms are newly established and lectotypes are designated for *C. signatipennis* Karsch and *C. neutralipennis* Karsch. In the course of examining the ovipositor as a source of taxonomic characters it was necessary to homologize its parts in order to establish a terminology generalized enough for use in taxonomic studies on other Tettigoniidae.

Catoptropteryx latipennis Chopard, as mentioned above, is incorrectly placed in this genus and is removed from it by the following synonymy, based on an examination of the type-specimens:

Symmetropleura plana (Walker)

Phaneroptera plana Walker, 1869 : 339. Holotype ♂, South Africa : Natal (BMNH) [examined].
Tylopsis plana (Walker) Kirby, 1906 : 441.
Symmetropleura plana (Walker) Ragge, 1964 : 298.
Catoptropteryx latipennis Chopard, 1955 : 267. Holotype ♂, South Africa : Cape Province, Tzitzikama Forest, Stormsrivierpiek (UZI Lund) [examined]. **Syn. n.**

ACKNOWLEDGEMENTS

I want to express my gratitude to the following specialists who, directly or indirectly, have made available to me type specimens and other material from their respective institutions:

Mr. P. Basilewsky, Dr. W. Bazyluk, Dr. M. Beier, Dr. I. J. Cantrall, Mr. R. H. Carcasson, Dr. M. Descamps, Mr. M. Donskoff, Mr. Y. Gillon, the late Dr. H. J. Grant, Dr. K. K. Günther, Dr. R. Kumar, Mr. M. Lamotte, Professor C. H. Lindroth, Miss J. M. McKay, Mr. E. Morales Agacino, Dr. E. C. G. Pinhey, Dr. D. C. Rentz, Dr. C. H. F. Rowell, the late Dr. G. van Son, Mr. L. D. E. F. Vesey-Fitzgerald, Mr. J. A. Whellan.

My especial thanks are due to Dr. D. R. Ragge for valuable criticism and advice during the preparation of this work ; to Professor G. G. E. Scudder for his comments on the interpretation of the ovipositor homologies ; and to Dr. M. C. Eluwa for observations on the biology of *Catoptropteryx* Karsch and the use of his photograph of the eggs (Plate 1, fig. 1).

MATERIAL

The museums and other institutions listed below have provided the material for this study. The abbreviations used in the text to refer to type-depositories are given in parentheses.

Academy of Natural Sciences of Philadelphia (ANS) ; British Museum (Natural History) (BMNH) ; California Academy of Sciences, San Francisco (CAS) ; Coryndon Museum, Nairobi (CM) ; Instituto Español de Entomología, Madrid (IEE) ; Instytut Zoologiczny of the Polska Akademia Nauk, Warsaw (IZPAN) ; Laboratoire d'Entomologie, Office de la Recherche Scientifique et Technique Outre-Mer, Abidjan (ORSTOM) ; Makerere University College, Kampala (MUC) ; Musée Royal de l'Afrique Centrale, Tervuren, Belgium (MRAC) ; Muséum National d'Histoire Naturelle, Paris (MNHN) ; Museum of Zoology, University of Michigan, Ann Arbor (MZUM) ; National Museum, Bulawayo (NM) ; Naturhistorisches Museum, Vienna ; Transvaal Museum, Pretoria (TM) ; Universitetets Zoologiska Institution, Lund, Sweden (UZI) ; University of Ghana, Accra (UG) ; Zoologisches Museum of the Humboldt-Universität, Berlin (ZMHU).

TREATMENT

It has been found necessary in attempting to provide a reliable means of identification of the species of *Catoptropteryx* Karsch to make use of a few characters hitherto not commonly employed in taxonomic work on the Tettigoniidae. One class of characters that may deserve comment is that based on the coloration of the integument. Many workers still tend to regard colour characters as unreliable in the sense that they are so often subject to individual variation as to be of dubious value in differentiating the species. However, the level of significance of differences in coloration, as with any other type of structural difference, varies from group to group, and there is no doubt that within this genus alone a particular feature of the colour pattern may show a consistent difference between a certain two species while in other species the same difference is embraced by intraspecific variation. In using the present revision, therefore, where a colour character is in the same state in all the examined material of a species, the value of this should not be underestimated but assessed as a function only of the number of specimens on which the description is based.

Much work has been done, especially in recent years, on the acoustic behaviour of Orthoptera and the high taxonomic significance of song patterns is widely recognized. However, although the nature of sounds produced by Ensifera is clearly dependent in part on the structure of the stridulatory organ, and although this structure can be fairly readily examined in dead specimens, very little use has been made of this as a source of characters in systematic work on the group. The present work makes use of the three most easily examined attributes of the stridulatory file, namely its gross appearance, length and number of teeth. The drawings of files were made from stained and cleared preparations of actual specimens, using a microprojector. The measurement of tooth number and file length was made on nitrocellulose replicas of a subsample of each species. The technique for making the replicas was essentially that described by Ragge (1969 : 172). A drop of 5% ammonia solution containing a trace of detergent as a wetting-agent was used to relax the wing base. To obtain sufficiently robust replicas from this genus it was necessary to coat the whole of the proximal centimetre of the ventral surface of the wing. The replicas were examined by diffuse transmitted light. ' Tooth number ' (T) includes all the teeth, however rudimentary, that can be discerned under the low power (× 100) of a microscope. ' File length ' (F), which was measured using a screw micrometer eyepiece, is the linear distance between the first and last tooth. The measurements made on replicas do not differ significantly from those made on the wing itself. Both tooth number and average tooth density (T/F) were found to be useful characters. The interspecific and infraspecific variation in these variates is shown in the scatter diagrams of tooth number on file length (Text-fig. 1). In any one species, there is a broad correlation between tooth number and file length, as might be expected, but for the genus as a whole there is no such significant correlation owing to the large variation of average tooth density between species. For example, the sample mean of this last variate is 24·56 (teeth per mm) for *C. aurita* sp. n. and 63·51 for *C. nanus* sp. n., producing widely separated clusters of

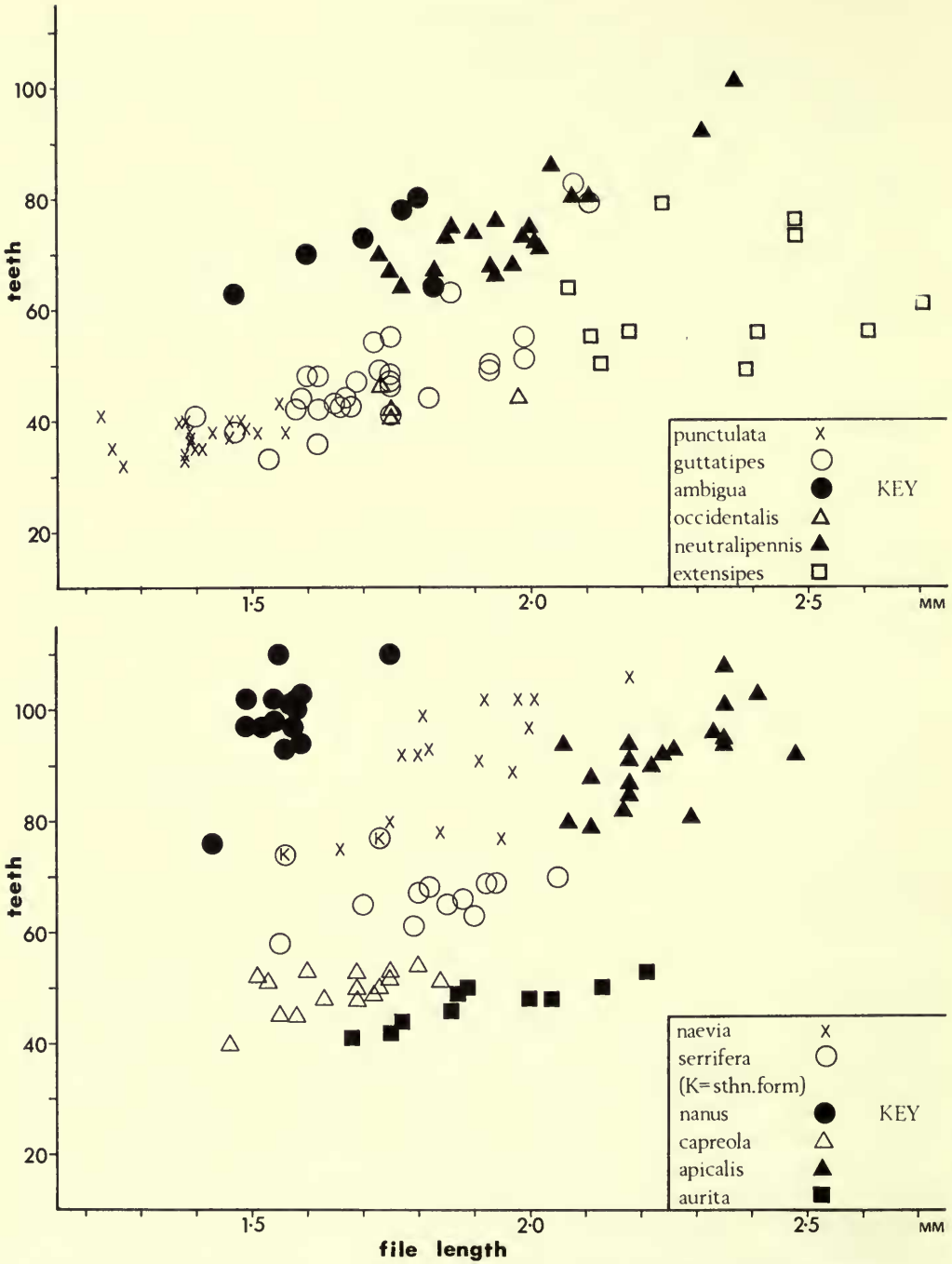


FIG. 1. Scatter diagrams of tooth number plotted against file length for the left male stridulatory file of *Catoptropteryx* spp.

points for these two species. While there is of course considerable overlap, for the samples plotted each species does have a characteristic distribution of points and many pairs of species can be clearly differentiated by simultaneous consideration of tooth number and file length.

Although the form of the ovipositor valves is frequently used in the systematics of the Phaneropterinae, little use is made of the more complex assembly of sclerites at their base. This constitutes a mechanism for the control of the movements of the valves, in particular during oviposition, and its structure probably relates closely to oviposition behaviour. This aspect is peripheral to the present study except insofar as it is suggested that the form of the basal mechanism, like that of the valves themselves, is likely to be maintained within narrow limits of variability, and for this reason may be expected to provide reliable characters for the identification of the species. The shape of the basal sclerites is complex in many Phaneropterinae, and almost always so in those genera, like *Catoptropteryx* Karsch, in which the valves are abnormally small, and whatever the functional significance of the form may be its variation from species to species is often discrete and readily perceived. Too commonly in the Tettigoniidae the males of a group of species may be easily distinguished by clear differences in their genitalia, while identification of the females relies heavily on their topographic association with identifiable males. In many such cases study of the basal mechanism of the ovipositor reveals good specific characters, and on the assumption based on this observation, that further use will be made of this structure in future work on phaneropterine taxonomy, I have considered it advisable to establish a morphological nomenclature at once rather than lay the foundation of a confusing diversity of terms by constructing an *ad hoc* terminology on a purely descriptive basis. Apart from the retention of the terms ' dorsal valves ' and ' ventral valves ', already commonly used and unambiguous in meaning, in preference to ' gonoplac ' and ' first gonapophysis ', the ovipositor is described using the nomenclature of Scudder (1961*a*, 1961*b*, 1964). Scudder and Harz intend to propose the terms ' supragonangulum ' and ' infragonangulum ' for the anterodorsal and posteroventral divisions of the gonangulum of the Tettigoniidae (Scudder *in lit.*) and I am anticipating the publication of their work by adopting these terms here. The structure, interrelationships and homologies of the sclerites of the ovipositor of *Catoptropteryx* Karsch were determined by examination of examples of all the species well represented in the available material. The abdomens of dried specimens were macerated in 10% potassium hydroxide and studied under isopropyl alcohol and in cleared and stained slide preparations. The results of this investigation are summarized diagrammatically in Text-fig. 2. The most useful specific differences in the basal mechanism are to be found by examining the form and relative sizes of the lobe of the infragonangulum (*iga*) and the first gonocoxa (*gc* 1), and the spatial relationship of these sclerites to each other. The supragonangulum (*sga*) and second gonocoxa (*gc* 2) also show specific differences but these tend to be less well defined and the sclerites are not always so readily examined in dried material. The subtlety of shape of the ovipositor parts makes verbal diagnosis difficult and this has therefore been minimized in the species

descriptions, reliance being placed almost entirely on the text-figures for comparison of ovipositor characters. When comparing specimens with the text-figures it is essential to bear in mind the possible effects of a number of factors, the operation of which leads to a misleading diversity in the appearance of ovipositors of the same species. All the drawings have been made from dried specimens in which the process of drying causes variable distortion of sclerites, variable lateral displacement of the subgenital plate, and variation in the degree to which the anterior part of the basal mechanism is concealed by the ninth and tenth abdominal tergites. Further, as the ovipositor in life consists of a system of moving parts, the positions of the parts relative to one another are subject to variation ; for example, in Text-fig. 2, anticlockwise rotation of the plate formed by the fused gonangulum and first gonocoxa would result in an anterior displacement of the second gonocoxa and dorsal valve, posterior displacement of the ventral valve, and partial concealment of the supra-gonangulum beneath the ninth abdominal tergite. This sort of change produces an unexpectedly large diversity in the gross appearance of the ovipositor.

Every species description includes the ranges in the material examined of certain linear measurements commonly found to be useful in tettigoniid taxonomy at this level. All measurements are given in millimetres. Means are not given for two reasons : the samples are extremely heterogeneous and the relative contributions of geographic and intrapopulational variation to the value of the mean are not

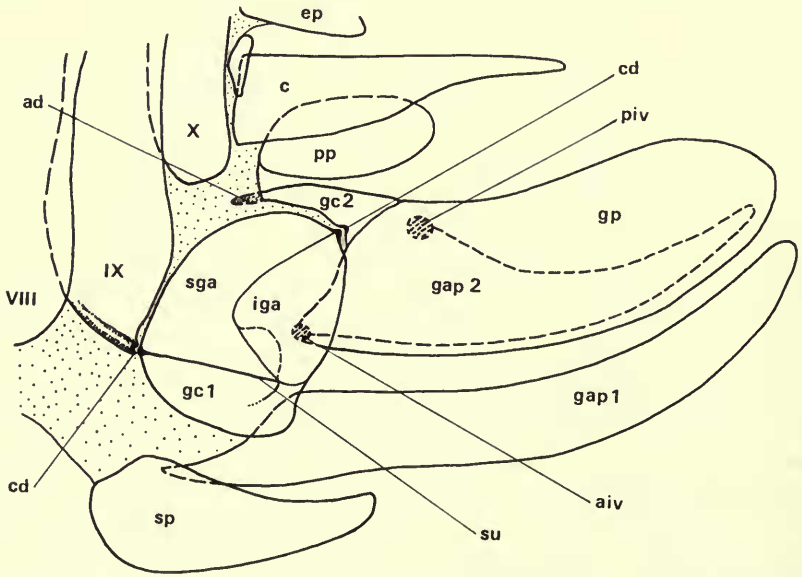


FIG. 2. Diagram of the ovipositor of a generalized *Catoptropteryx* sp. Membrane is shown stippled. *ad*, apodeme ; *aiv*, anterior intervalvula ; *c*, cercus ; *cd*, condyle ; *ep*, epiproct ; *gap* 1, first gonapophysis (= ventral valve) ; *gap* 2, second gonapophysis ; *gc* 1, first gonocoxa ; *gc* 2, second gonocoxa ; *gp*, gonoplac (= dorsal valve) ; *iga*, infragonangulum ; *piv*, posterior intervalvula ; *pp*, paraproct ; *sga*, supragonangulum ; *sp*, subgenital plate ; *su*, suture ; VIII, IX, X, terga.

assessed ; even in a (biologically) homogeneous sample knowledge of the mean alone, with no estimate of the variance or skewness of the distribution, is not very useful. Measurements were made using calipers, with the exception of the file length (see above) and the median length of the pronotum, for both of which a screw micrometer eyepiece was used. ' Total length ' means the distance from the most anterior part of the head (excluding its appendages) to the tip of the flexed hind wings. ' Length of fore wings ' is the distance from the distal margin of the second axillary sclerite to the apex of the wing, and is conveniently measured by inserting one point of the calipers into the small notch in the wing extending distad from this sclerite.

In descriptions of the legs and antennae the terms ' internal ', ' external ', ' dorsal ' and ' ventral ' refer to these appendages in standard positions, the antennae and fore legs directed forwards and the mid and hind legs directed backwards.

The wing-venation is described using the nomenclature of Ragge (1955). The veins used in the diagnosis of *Catoptropteryx* spp. are illustrated and named in Text-fig. 65.

TAXONOMIC STRUCTURE

It may be necessary to stress that throughout this paper, where expressions such as ' affinity ' and ' related ' are used without qualification no phyletic meaning is intended, such terms referring only to the degree of morphological resemblance observed. Whether phyletic information can be inferred from the evidence of the few morphological characters studied in this revision is another matter.

Text-fig. 3 is a schematization of the affinities of the species of *Catoptropteryx* Karsch based on an intuitive selection of characters from the ovipositor, fore wing venation, eyes, tympanic organs and male cerci. It is not based on a rigorous phenetic analysis but is merely an attempt to give visual form to a largely subjective assessment of the relations among the species. It can be seen that the genus falls into three principal species-groups comprising respectively 1) *extensipes*, 2) *aurita* and *serrifera*, and 3) the remaining twelve species. The second group is linked to the third both morphologically and geographically by *C. serrifera* sp. n. The third and largest group subdivides itself fairly readily into the following three subgroups : i) *nanus*, *ramulosa*, *capreola* and *naevia ;* ii) *apicalis*, *afra* and *neutralipennis ;* iii) *ambigua*, *nigrospinosa*, *punctulata*, *guttatipes* and *occidentalis*. Of these, ii) and iii) are strongly linked through *C. neutralipennis* Karsch.

C. aurita sp. n. is the only species in which the internal auricle of the tympanic organs is at all developed. Although in the Phaneropterinae this most commonly has the status of a generic character, the inclusion of *C. aurita* sp. n. in this genus, with the consequent heterogeneity of the latter, is justified by the observation that *C. serrifera* sp. n., which has no tympanic auricles, is rather more closely related to the auriculate species than it is to the rest of the genus. I can find no real justification for the attachment of special taxonomic significance to the difference in the tympanic organ of these two species. Morphogenetically, the difference might readily be assumed to be trivial in that the auriculate form could be simply derived from the

open form by a slight expansion of the ventral internal rim of the tympanic opening. The reverse transformation is equally feasible. A decision as to which may be the primitive and which the derived form of this structure might be of some biogeographic interest, as the auriculate species is the only one with an East African distribution. This decision clearly cannot be based on the kind of evidence available here. However, one purely speculative possibility is that the auriculate form is primitive and the open form derived from it. It might be supposed for example that in an environment in which predation pressure is high, selection would favour reduction of the auricle to give completely open tympana, which could be the more

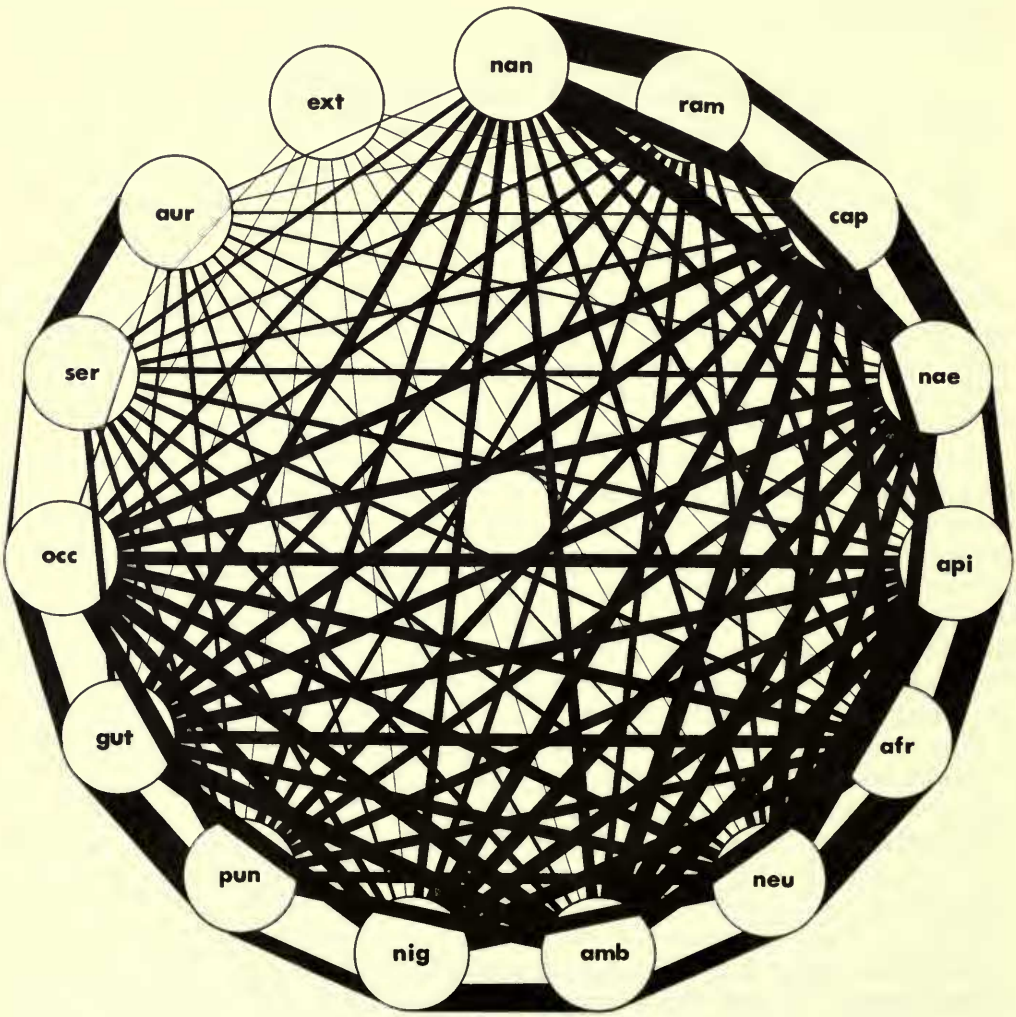


FIG. 3. Schematic diagram of the affinities of the species of *Catoptropteryx* Karsch. The thickness of the line joining two species is a measure of their morphological resemblance. (See text, p. 135).

efficient condition for nondirectional defence responses. If, moreover, the population density were high, reduction of mating efficiency by a reduction of the efficiency of directional responses to acoustic stimuli might not be a dominant selective factor. On the other hand, under conditions of low predator density and sparse populations, directional response capabilities may be favoured over nondirectional, and the auricle retained.

BIOLOGY

Nothing has been published relating to the biology of any of the species of *Catoptropteryx* Karsch. Moreover, since all the properly documented material examined was collected in light-traps, I have virtually no evidence in respect of ecological information. Enquiries made of collectors have not enabled any conclusions to be reached on this issue. The collecting localities almost all lie within areas of moist lowland forest or forest-savanna mosaic and several collectors suggest that it is likely to be a forest-dwelling genus. Dr. M. C. Eluwa, formerly of the University of Ibadan, however, has suggested (*in lit.*) that the principal habitat of the genus may be the bushes characteristic of farm lands. A few of the specimens examined had feculae attached and microscopic examination of these has revealed plant material only, without any trace of animal parts. In his laboratory Dr. Eluwa has fed specimens of an unidentified species of *Catoptropteryx* Karsch with tender leaves of *Ficus* sp. The dense sensory bristles of the valves of the ovipositor and their lack of teeth in the majority of species indicate that eggs are not usually deposited within plant tissues, and the small size of the valves argues against the use of deep crevices in soil or bark as oviposition sites. Dr. Eluwa supports this deduction with a single observation of oviposition in the laboratory. A row of 29 eggs was deposited along a vein on the abaxial surface of a *Ficus* leaf (see Plate 1, fig. 1).

CATOPTROPTERYX Karsch

Catoptropteryx Karsch, 1890*b* : 361. Type-species, by monotypy, *Catoptropteryx guttatipes* Karsch, 1890.

♂ ♀. Small to medium size. Integument generally smooth and shiny.

Length of antennae about 1¼ times total length ; margin of antennal scrobes not, or only slightly, extending above fastigium of frons. Fastigium of vertex compressed, narrow, width less than half width of first antennal segment, horizontal or very slightly declinate, sulcate dorsally. Fastigium of frons triangular, acuminate, almost meeting ventral surface of fastigium of vertex. Eyes large to very large, more or less prominent, sub-globose or slightly elliptical.

Pronotal disk more or less planar, lateral margins diverging posteriad, anterior margin straight or slightly concave, posterior margin moderately to strongly convex ; lateral lobes of pronotum more or less planar, meeting disk at very slightly rounded right-angle, height usually exceeding, sometimes about equal to, length. Fore wings extending well beyond hind knees, length about 1½ times hind femur length ; *Sc* and *R* contiguous in proximal half ; R_s arising slightly proximad of centre ; cross-veins usually somewhat regular and parallel ; archedictyon fairly open-textured, membrane transparent. ♂ stridulatory organ small, without mirror ; stridulatory rib not prominent dorsally ; file with 30–110 teeth. ♀ stridulatory apparatus present, consisting of one or more thickened, transverse veinlets near posterior margin of cubito-anal area of right

fore wing, each bearing dorsal row of small, regular, hook-shaped spines with points directed distad. Hind wings fully developed, extending beyond fore wings in flexed position by about $\frac{1}{5}$ fore wing length. Fore coxae with long dorsal spine of circular transverse section. Fore femora with about 1–4 very small internal ventral spinules (often 0 in *C. extensipes* Karsch). Mid femora with about 1–4 very small external ventral spinules (often 0 in *C. extensipes* Karsch). Hind femora with about 3–6 internal and 3–6 external ventral spinules ; hind knees with 2 small spinules on each lobe. Fore and mid tibiae sulcate dorsally, each with about 1–5 internal and 1–5 external ventral spurs ; fore tibiae with usually 0, sometimes 1–2 external dorsal spurs in addition to apical ; mid tibiae with 0–3 internal dorsal spurs in addition to apical. Hind tibiae flat or somewhat convex dorsally, with well developed dorsal carinae, about 4–10 internal and 10–20 external ventral spurs, and about 20–35 dorsal spinules on each side ; apex on each side with 2 large curved ventral spurs and 1 large dorsal spur. Tympanic organs externally without auricles, internally auricle absent or (*C. aurita* sp. n.) more or less well developed.

Abdominal tergites simple, without spines ; tenth tergite of ♂ unmodified. Epiproct simple, triangular. ♂ cerci unbranched, unarmed except for small apical or subapical spinule. ♀ cerci abruptly narrowed in distal quarter. Ovipositor very small, length about $\frac{2}{3}$ to $\frac{1}{2}$ median length of pronotum ; margins of valves mostly smooth, occasionally finely crenulate or serrate at apex of dorsal valve ; basal mechanism well developed, 1st gonocoxa usually as large as or larger than infragonangulum. ♂ subgenital plate with shallow triangular excision in distal margin ; styles present, usually very small, sometimes apparently not articulated. ♀ subgenital plate simple, with apical margin entire.

General coloration pale green to olive-green, sometimes overlaid with purple-brown over fore wings, and with variable brown or black markings often present on lateral lobes of pronotum and base and apex of fore wings. Hind wings hyaline or faintly fumose (markedly fumose in *C. extensipes* Karsch). Dark areas of variable size usually present at some or all of following loci : post-ocular regions of head ; dorsal surface of antennae ; fore tibiae in region of tympanic organ, especially in lateral sulci ; hind tibiae proximally at two points on each side and one point dorsally, and around bases of ventral spurs. All spurs and spinules blackened, at least apically.

While *Catoptropteryx* Karsch is rather easily recognized (see Plate 1, figs. 2–3), it is not easy to make a brief list of diagnostic features distinguishing it from its closest relatives. It resembles quite closely *Caedicia* Stål from which it seems to be principally distinguished by its more globular eyes (or very much larger eyes in the case of *C. extensipes* Karsch) and less prominent antennal scrobes. Confusion of these genera is in practice unlikely as *Caedicia* Stål has an Australian and Austro-oriental distribution. *Dapanera* Karsch, however, is extremely similar and has a similar distribution to *Catoptropteryx* Karsch. The former genus may be distinguished by the fore wings which are broader and have a denser, more opaque archedictyon, by the well developed ovipositor, and (except from *C. aurita* sp. n.) by the auriculate inner tympanum. The most useful characters distinguishing the species of *Catoptropteryx* Karsch are undoubtedly to be found in the basal mechanism of the ovipositor (see p. 133), the male cerci and stridulatory organ (see p. 131) and the coloration of the fore wings and pronotal lobes (see p. 131). It is essential, however, for reliable determination to take into account all the characters treated in the diagnostic descriptions.

The distribution of the genus falls into two distinct areas of tropical Africa (see Text-fig. 4). *C. aurita* sp. n. has an East African distribution, while the rest of

the genus has a distribution characteristic of many West African Tettigoniidae, extending from Sierra Leone and Guinea to Angola, Congo and Uganda.

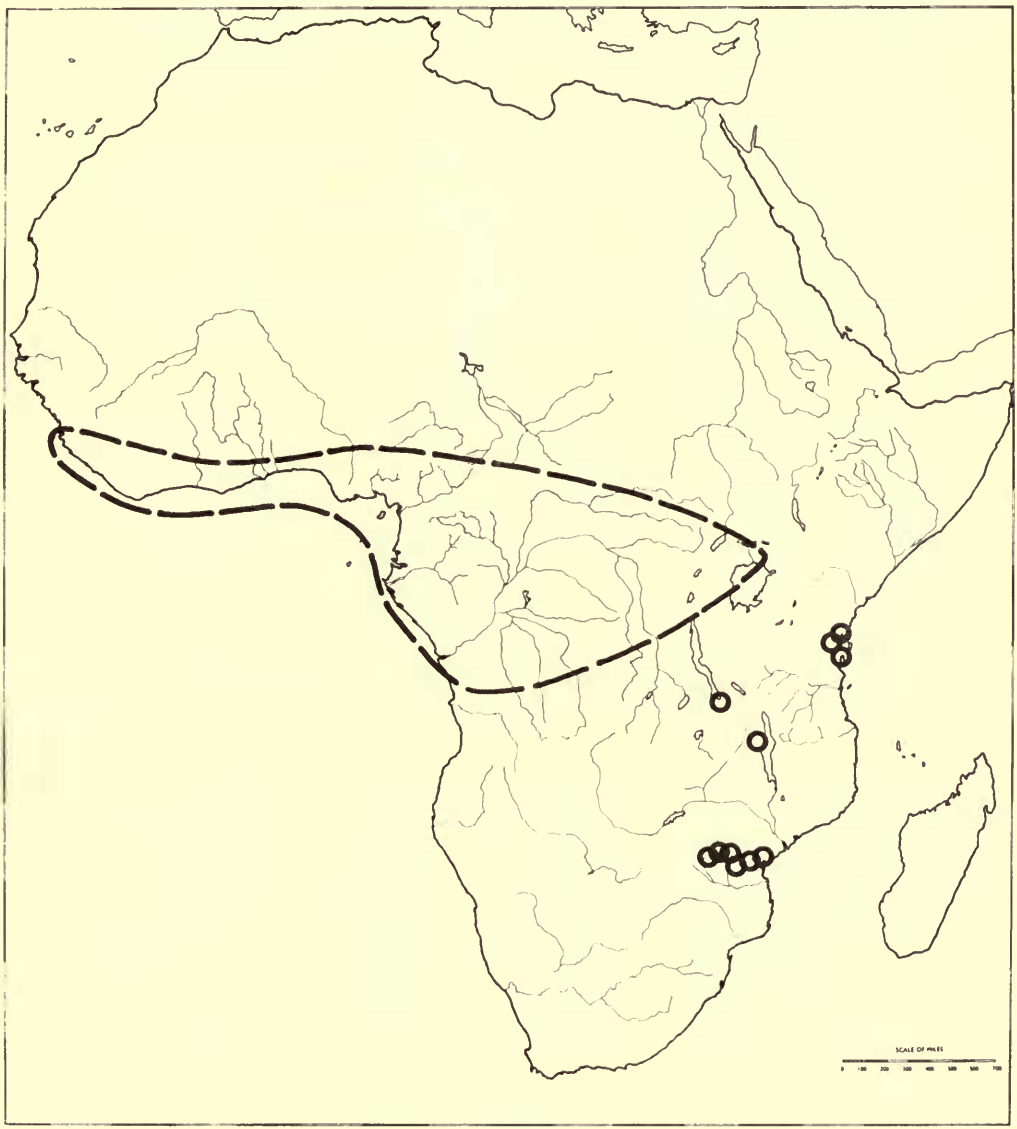


FIG. 4. Map showing the distribution of *Catoptropteryx aurita* sp. n. (circles), and the approximate distribution of the rest of *Catoptropteryx* Karsch.

Key to the Species

The characters employed in the key are chosen partly for convenience in use, and are not always those on which the most weight is placed in the diagnoses of the species. Hence, the key does not provide a complete diagnosis of each species, this being a function of the descriptions. Every specimen, therefore, needs to be compared with the description indicated by the key before the identification can be considered reliable.

1 Eyes very large, elliptic in outline, as in Text-figs. 5–6, 8–9. Hind tibiae deep brown to black with 2 broad, well defined, very pale bands in proximal third ***C. extensipes*** Karsch (p. 168)

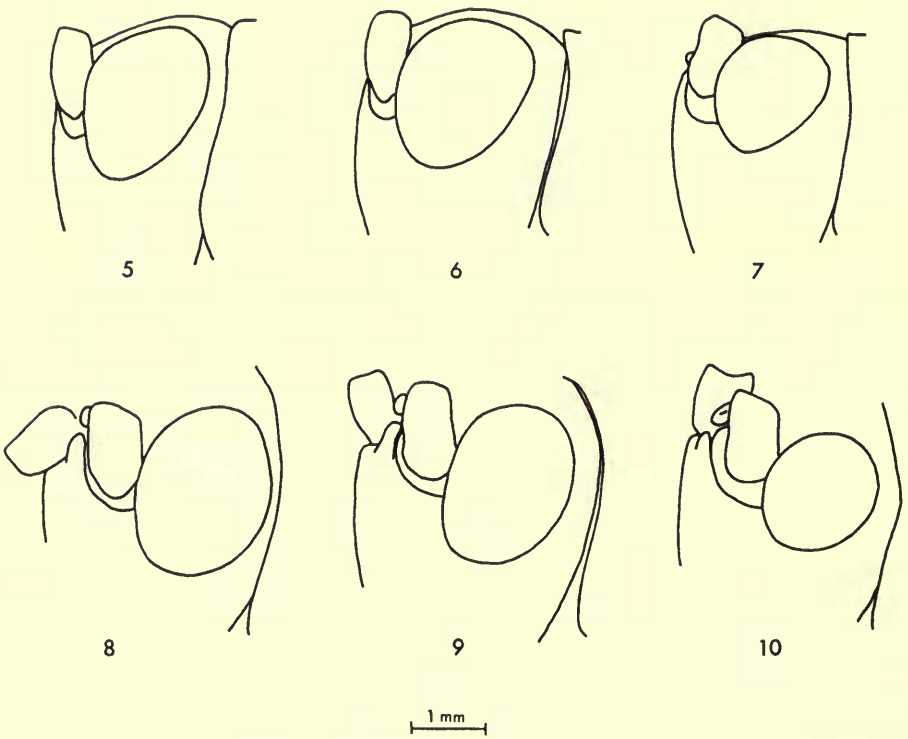
– Eyes moderately large, sub-globose, as in Text-figs. 7, 10. Hind tibiae if brown or black then not with 2 pale bands in proximal third. 2

2 Auricles present on internal side of tympanic organs : rudimentary to quite well developed (Text-figs. 12–13). (East Africa) . . . ***C. aurita*** sp. n. (p. 167)

– Tympanic auricles totally absent ; tympanic organs open on both sides (Text-fig. 11). (West and Central Africa) 3

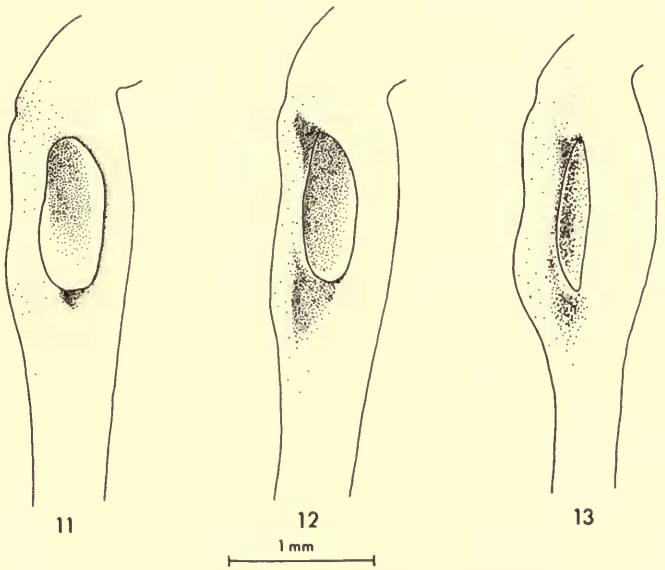
3 Base of fore wings with no dark marking (Text-fig. 14) 4

– Base of fore wings with brown or black mark, sometimes small and inconspicuous, extending distad from region of second axillary sclerite (Text-figs. 15–17) . . 9

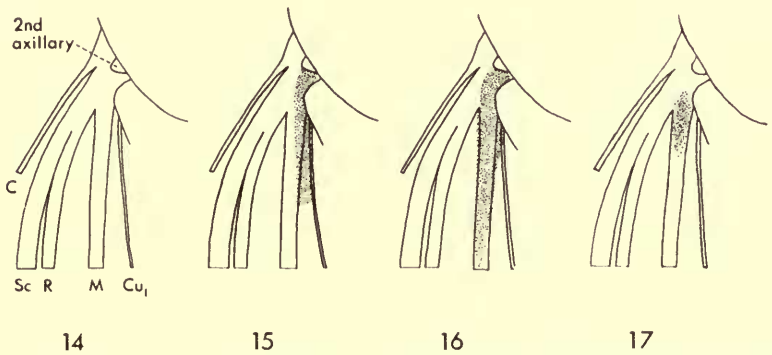


Figs. 5–10. Left eye, 5–7 viewed from the side, 8–10 viewed at about 90° to the plane of insertion of the eye on the head ; 5, 8, *Catoptropteryx extensipes* Karsch (Cameroon) ; 6, 9, *C. extensipes* Karsch (Ghana) ; 7, 10, *C. apicalis* (Bolívar).

4 Lateral lobes of pronotum with no dark brown or black marking 5
– Lateral lobes of pronotum dorsad with dark brown to black marking, from single small dark spot to broken or continuous longitudinal stria 6
5 Lateral lobes of pronotum as in Text-fig. 37, clearly higher than long. Apex of dorsal valves of ovipositor smooth (Text-fig. 54) ***C. nigrospinosa*** (Brunner) (p. 160)
– Lateral lobes of pronotum as in Text-fig. 42, not, or only very slightly, higher than long. Apex of dorsal valve of ovipositor with about 4 very small irregular teeth (Text-fig. 58) . . . . . ***C. serrifera*** sp. n. (p. 165)



FIGS. 11–13. Right tympanic organ viewed from the internal side of the tibia of 11, *Catoptropteryx apicalis* (Bolívar) ; 12, *C. aurita* sp. n. (Mozambique) ; 13, *C. aurita* sp. n. (Zanzibar).

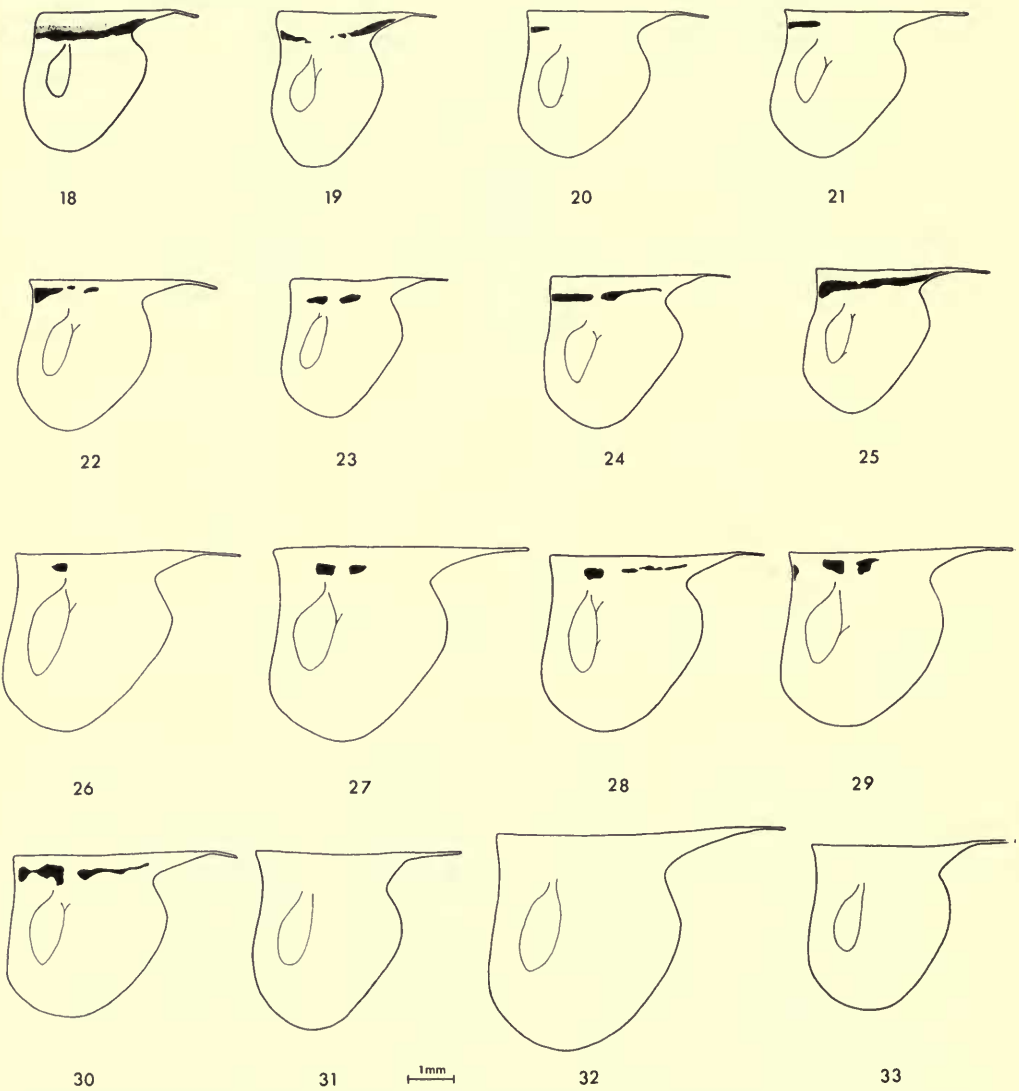


FIGS. 14–17. Diagram showing the types of coloration of the fore wing base of *Catoptropteryx* Karsch : dorsolateral view of left female fore wing of 14, *C. capreola* Karsch ; 15, *C. guttatipes* Karsch ; 16, *C. punctulata* (Karsch) ; 17, *C. afra* (Karsch).

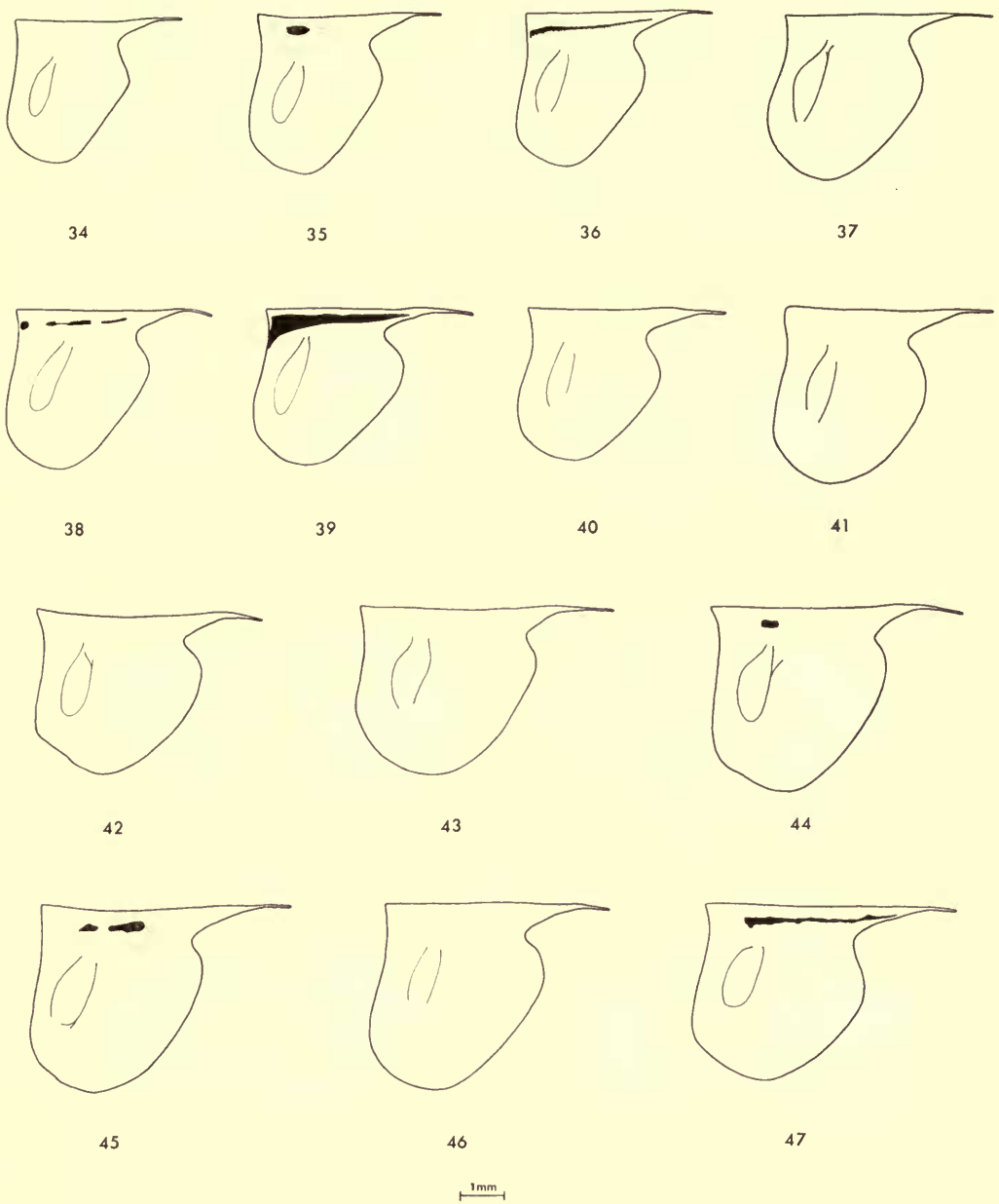
6 Venation of fore wings as in Text-figs. 60, 61 or 62 ; pattern of parallel veins in distal half of wing ; R_1 with more than 2 branches ; *MA* branched or unbranched 7

– Venation of fore wings as in Text-fig. 63 ; veins in distal half not parallel ; R_1 bifurcate ; *MA* unbranched 8

7 Venation of fore wings as in Text-fig. 60 ; *MA* bifurcate or unbranched ; R_s usually bifurcate. Area between pronotal disk and longitudinal stria of lateral lobe orange-yellow (Text-fig. 18) . . . . . ***C. nanus*** sp. n. (p. 147)



FIGS. 18–33. Lateral view of the pronotum of 18, *Catoptropteryx nanus* sp. n. ; 19, *C. ramulosa* sp. n. ; 20–25, *C. capreola* Karsch ; 26–30, *C. naevia* sp. n. ; 31, *C. apicalis* (Bolívar) ; 32, *C. afra* (Karsch) ; 33, *C. neutralipennis* Karsch.

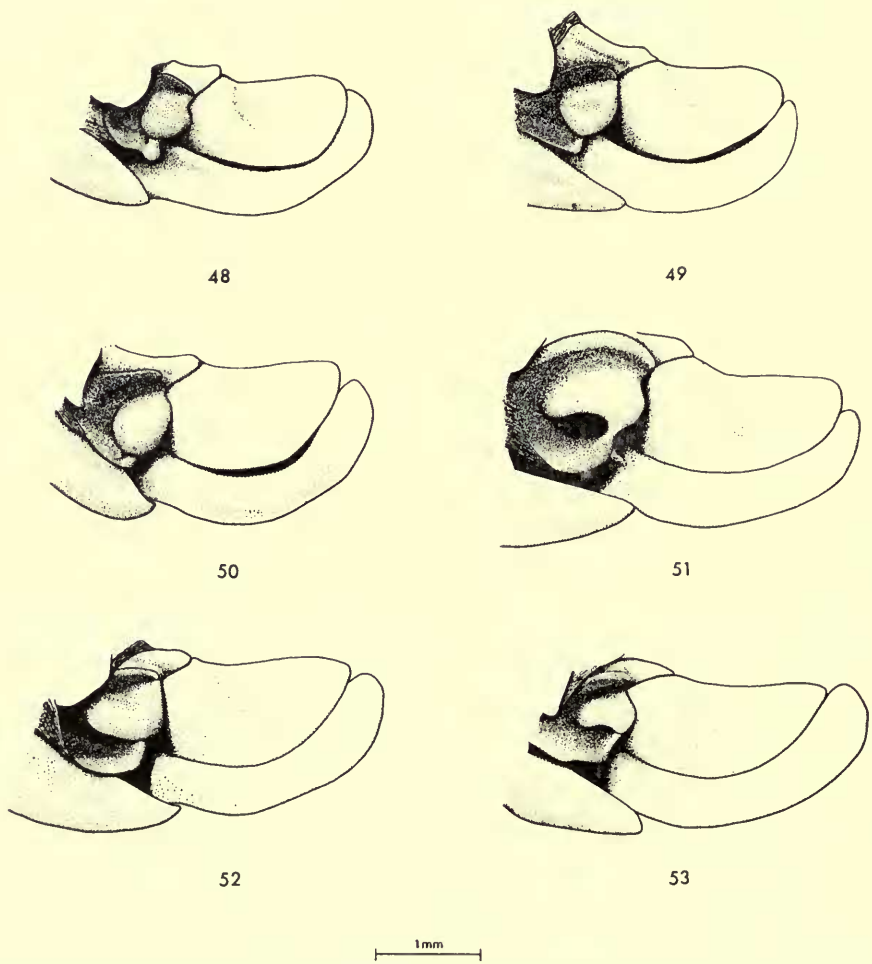


FIGS. 34–47. Lateral view of the pronotum of 34–36, *Catoptropteryx ambigua* sp. n. ; 37, *C. nigrospinosa* (Brunner) ; 38–39, *C. punctulata* (Karsch) ; 40, *C. guttatipes* Karsch ; 41, *C. occidentalis* sp. n. ; 42, *C. serrifera* sp. n. ; 43–45, *C. aurita* sp. n. ; 46, *C. extensipes* Karsch (Cameroon) ; 47, *C. extensipes* Karsch (Ghana).

– Venation of fore wings as in Text-figs. 61–62 ; *MA* with about 6 branches generated pectinately ; R_s with 3 branches. Lateral lobes of pronotum as in Text-fig. 19 ; cuticle same colour above stria as below . . . ***C. ramulosa*** sp. n. (p. 148)

8 Coloration of pronotal lobes as in Text-figs. 20–25. External spinules of hind femora blackened only apically (Text-fig. 66). Stridulatory file with about 40–54 teeth. . . . . ***C. capreola*** Karsch (p. 151)

– Coloration of pronotal lobes as in Text-figs. 26–30. Some at least of external spinules of hind femora wholly black, and usually set in dark patches on femoral carina (Text-fig. 67). Stridulatory file with about 75–106 teeth.
C. naevia sp. n. (p. 153)



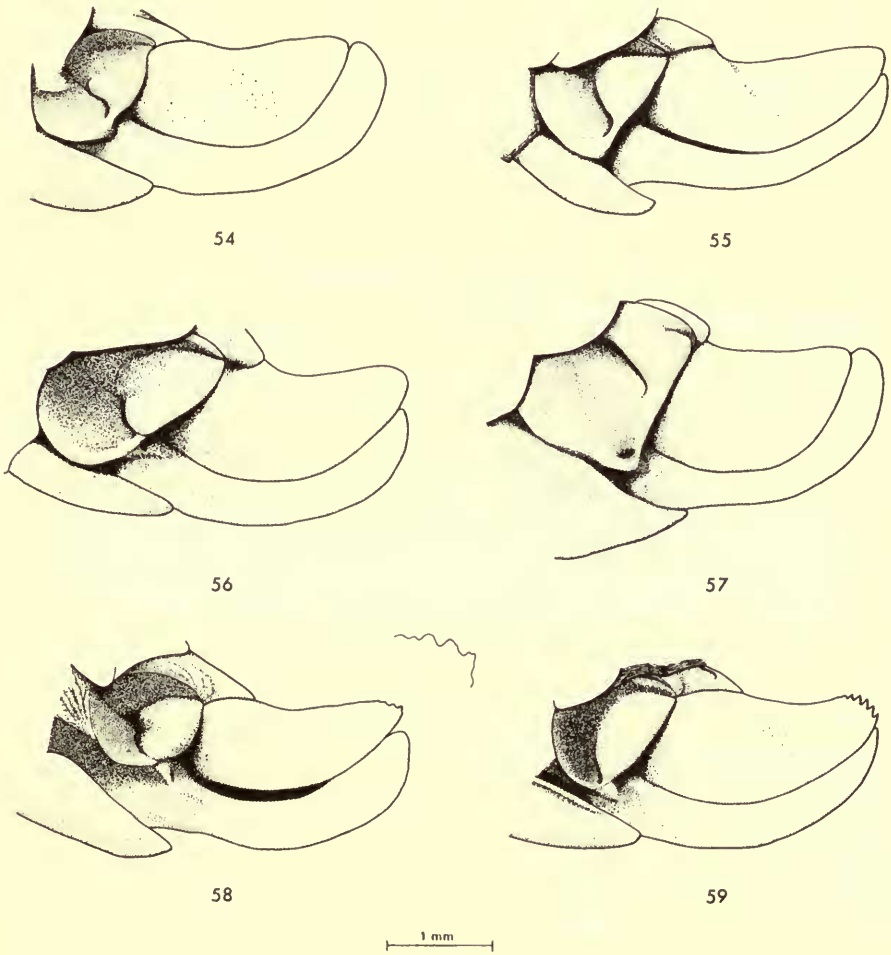
FIGS. 48–53. Lateral view of the ovipositor of 48, *Catoptropteryx ramulosa* sp. n. ; 49, *C. capreola* Karsch ; 50, *C. naevia* sp. n. ; 51, *C. apicalis* (Bolívar) ; 52, *C. neutralipennis* Karsch ; 53, *C. ambigua* sp. n.

9 Fore wings as in Text-fig. 64 ; scattered fuscous or fuscescent cells, isolated or in small groups, in areas R, R_1 or R_s. Cerci of ♂ depressed in apical half (Text-fig. 74). Stridulatory file as in Text-fig. 88, in posterior quarter abruptly sinuose with very closely spaced teeth. Valves of ovipositor unusually slender (Text-fig. 55) . . . . . ***C. punctulata*** (Karsch) (p. 161)

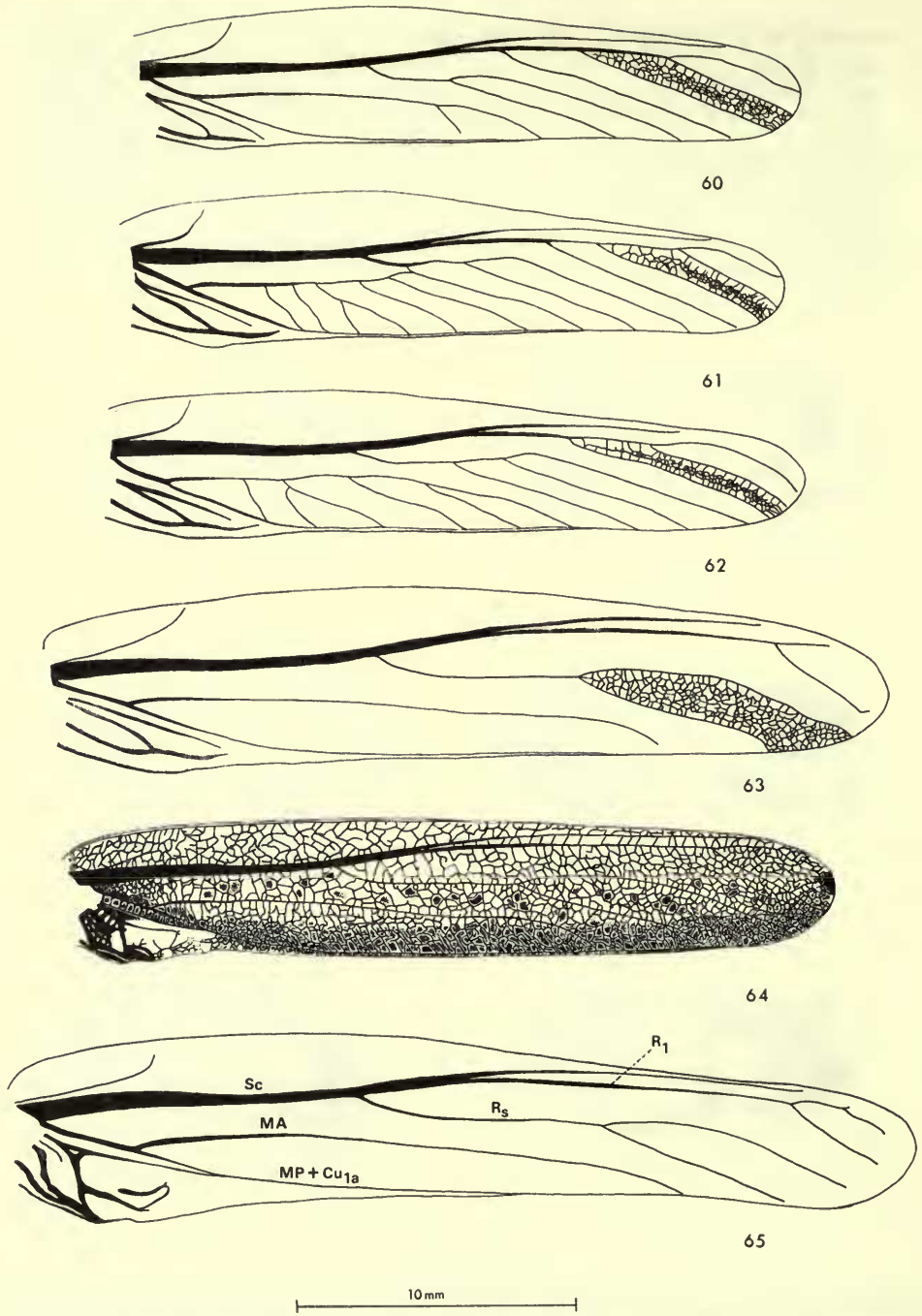
– Fore wings with no isolated dark cells in areas R, R_1 or R_s. Cerci of ♂ not depressed. Stridulatory file with no abrupt sinuosity. Valves of ovipositor not unusually slender 10

10 Basal mark of fore wings of type shown in Text-fig. 15 : black stripe runs distad from beneath second axillary sclerite into area M, not centred on M 11

– Basal mark of fore wings not as above 12



FIGS. 54–59. Lateral view of the ovipositor of 54, *Catoptropteryx nigrospinosa* (Brunner) ; 55, *C. punctulata* (Karsch) ; 56, *C. guttatipes* Karsch ; 57, *C. occidentalis* sp. n. ; 58, *C. serrifera* sp. n. (with view of apex of dorsal valve, ×35) ; 59, *C. aurita* sp. n.



FIGS. 60–65. Right fore wing of 60, *Catoptropteryx nanus* sp. n., ♀ ; 61–62, *C. ramulosa* sp. n., ♀ ; 63, *C. capreola* Karsch, ♀ ; 64, *C. punctulata* (Karsch), ♂ ; 65, *C. extensipes* Karsch, ♂.

11 Cerci of ♂ short, strongly sinuose viewed in plane of principal curvature (Text-fig. 75). Ovipositor as in Text-fig. 56 . . . . . ***C. guttatipes*** Karsch (p. 163)
– Cerci of ♂ long and slender, moderately sinuose viewed in plane of principal curvature. Ovipositor as in Text-fig. 57 . . . . . ***C. occidentalis*** sp. n. (p. 164)
12 Basal mark of fore wings of type shown in Text-fig. 17 : proximally not extending as far as second axillary sclerite . . . . . ***C. afra*** (Karsch) (p. 156)
– Basal mark of fore wings of type shown in Text-fig. 16 : black stripe runs distad from beneath second axillary sclerite along centre of *M* 13
13 Hind tibiae wholly dark brown to black ; hind tarsi black or very dark green. Cerci of ♂ black dorsally. Basal mechanism of ovipositor as in Text-fig. 53 ***C. ambigua*** sp. n. (p. 159)
– Hind tibiae green or yellow-brown. Cerci of ♂ red- or yellow-brown, not black dorsally. Basal mechanism of ovipositor as in Text-figs. 51–52 . . . 14
14 Cerci of ♂ asymmetrically inflated at apex (Text-fig. 71). Basal mechanism of ovipositor as in Text-fig. 51 : inferior margin of lobe of infragonangulum emarginate from lateral viewpoint . . . . . ***C. apicalis*** (Bolívar) (p. 155)
– Cerci of ♂ not inflated at apex (Text-fig. 72). Basal mechanism of ovipositor as in Text-fig. 52 : inferior margin of lobe of infragonangulum not emarginate from lateral viewpoint. . . . . ***C. neutralipennis*** Karsch (p. 157)

DESCRIPTIONS OF THE SPECIES

Catoptropteryx nanus sp. n.

(Text-figs. 1, 18, 60, 68, 82)

♂. Eyes moderately large, sub-globose, strongly prominent.

Lateral lobes of pronotum as in Text-fig. 18 ; height clearly exceeding length. Fore wings as in Text-fig. 60 ; R_1 with about 4 branches arranged pectinately ; R_s usually bifurcate ; branches of R_1 and R_s straight and parallel, archedictyon between them denser and with smaller cells along centre of each area ; *MA* bifurcate or unbranched. Stridulatory file as in Text-fig. 82, narrow, almost straight, teeth closely spaced. Tympanic organs without auricles.

Cerci as in Text-fig. 68 ; short, arcuate, circular in transverse section, almost straight viewed in plane of principal curvature ; apex acute, bearing spinule.

Sides of thorax, and often external surface of hind femora in proximal half, whitish (probably white in living insect). Lateral lobes of pronotum whitish, with longitudinal black stria, usually unbroken, dorsad ; area between black stria and disk orange-yellow. Fore wings without basal or apical markings ; membrane blackened only in cells adjacent to $MP + Cu_{1a}$; inconspicuous striped pattern generated by venation of distal half of wings. Hind wings hyaline except for apical archedictyon. External spinules of hind femora blackened only apically.

66

67

FIGS. 66–67. Lateral view of part of the left hind femur of 66, *C. capreola* Karsch ; 67, *C. naevia* sp. n.

♀. As ♂ except for stridulatory organ and abdominal terminalia. Ovipositor very similar to that of *C. ramulosa* sp. n. (Text-fig. 48), but posterior angle of infragonangulum more rounded and obtuse, and supragonangulum somewhat less salient dorsad ; apical margin of dorsal valves smooth.

	Males	Females
Number of specimens examined :	26	25
Total length :	29·1–30·7	32·8–35·0
Median length of pronotum :	3·2–3·6	3·4–3·9
Length of hind femur :	15·1–17·2	16·3–18·0
Length of fore wing :	20·0–21·9	23·2–25·5
Stridulatory file—		
number examined :	15	
number of teeth (T) :	76–110	
length (replica) (F) :	1·43–1·75	
T/F :	53·1–71·0	

C. nanus sp. n. is very closely related to *C. ramulosa* sp. n., from which it can be distinguished by the venation of the fore wings and the coloration of the pronotum ; the striped pattern of the fore wings is much less marked than in the latter species. The relation between tooth number and file length is distinctive (see Text-fig. 1), though whether it differs significantly from that in *C. ramulosa* sp. n. is not yet known.

The species is known only from Cameroon.

Holotype ♀. CAMEROON : Efulen, 15.i.1923 (*Weber*) (ANS Philadelphia).

Paratypes. CAMEROON : ———, 1898–1899 (*Conradt*) 1 ♂ (IEE Madrid) ; Efulen, 17.xi.1920 (*Weber*) 1 ♂ (BMNH), 2.vii.1922 (*Weber*) 1 ♂ (BMNH), 24.x.1922 (*Weber*) 1 ♂ (ANS Philadelphia), 1 ♀ (BMNH), 10–21.xi.1922 (*Weber*) 1 ♂, 1 ♀ (BMNH), 4 ♂, 2 ♀ (ANS Philadelphia), xii.1922 (*Weber*) 3 ♂, 3 ♀ (BMNH), 6 ♂, 9 ♀ (ANS Philadelphia), i.1923 (*Weber*) 1 ♂, 1 ♀ (BMNH), 3 ♂, 3 ♀ (ANS Philadelphia), 10.ii.1923 (*Weber*) 1 ♀ (BMNH), 1 ♂, 2 ♀ (ANS Philadelphia), 12–22.iii.1923 (*Weber*) 1 ♀ (BMNH), 1 ♂ (ANS Philadelphia), iv.1923 (*Weber*) 1 ♂ (ANS Philadelphia), 5.iv.1923 (*Weber*) 1 ♂ (BMNH).

Catoptropteryx ramulosa sp. n.

(Text-figs. 19, 48, 61–62)

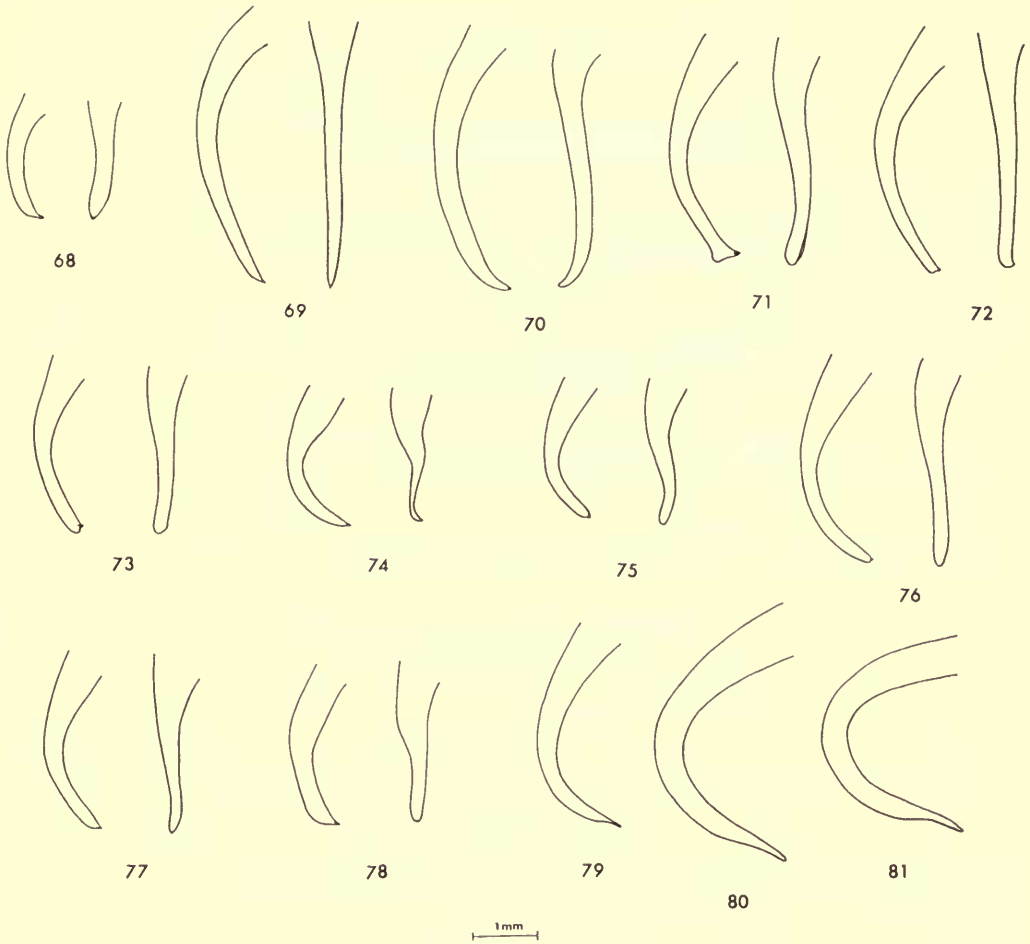
♂. Not known.

♀. Eyes moderately large, sub-globose, strongly prominent.

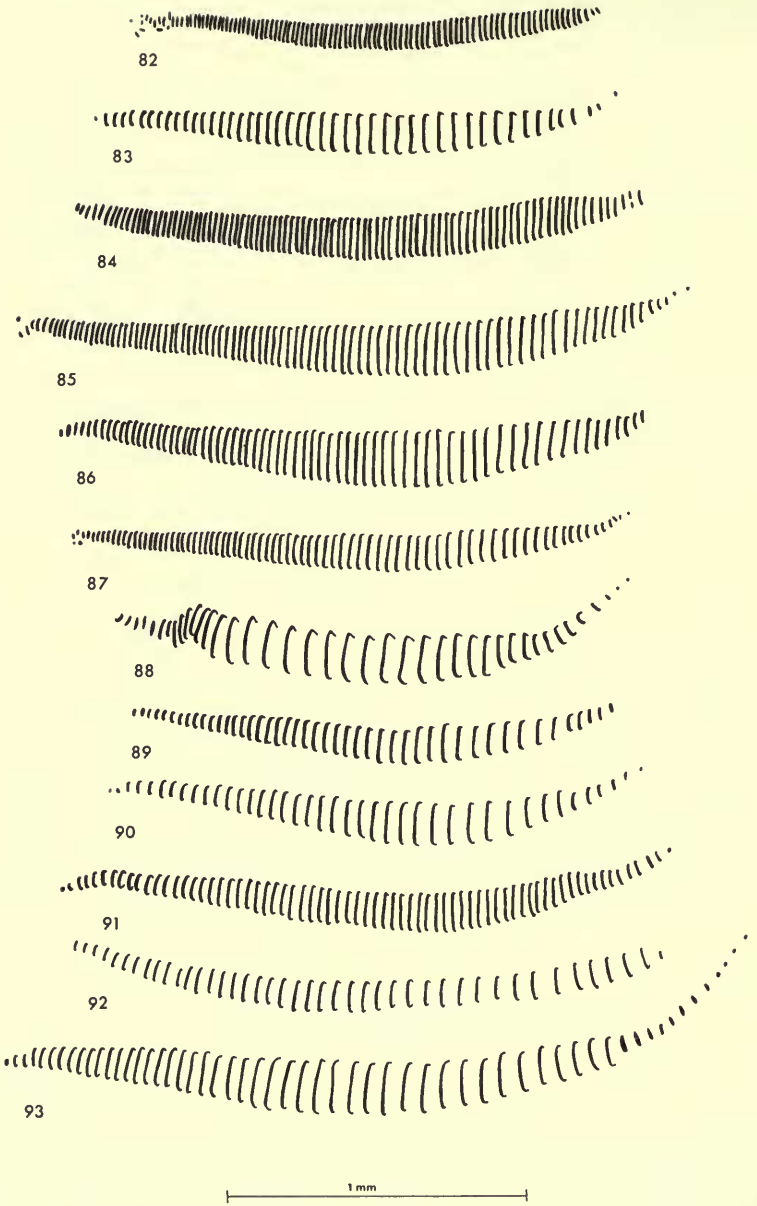
Lateral lobes of pronotum as in Text-fig. 19 ; height clearly exceeding length. Fore wings as in Text-figs. 61 and 62 ; branches of R_1, R_s and MA generated pectinately, sub-parallel, archedictyon between them denser and with much smaller cells along centre of each area ; R_1 with 3 or 4 branches, R_s with 3 branches, MA with about 6 branches. Tympanic organs without auricles.

Ovipositor as in Text-fig. 48, posterior angle of infragonangulum only slightly greater than 90° ; apical margin of dorsal valves smooth.

Sides of thorax pale green to ivory. Lateral lobes of pronotum not whitish, with somewhat variable broken black stria dorsad ; cuticle same colour above stria as below. Fore wings



FIGS. 68–81. Left male cercus viewed (left) from above, at 90° to its plane of principal curvature, and (right) from the outside, in the plane of principal curvature : 68, *Catoptropteryx nanus* sp. n. ; 69, *C. capreola* Karsch ; 70, *C. naevia* sp. n. ; 71, *C. apicalis* (Bolívar) ; 72, *C. neutralipennis* Karsch ; 73, *C. ambigua* sp. n. ; 74, *C. punctulata* (Karsch) ; 75, *C. guttatipes* Karsch ; 76, *C. occidentalis* sp. n. ; 77, *C. serrifera* sp. n. ; 78, *C. aurita* sp. n. ; 79, *C. extensipes* Karsch (Cameroon) ; 80, *C. extensipes* Karsch (Ivory Coast) ; 81, *C. extensipes* Karsch (Ghana).



FIGS. 82–93. Left stridulatory file of 82, *Catoptropteryx nanus* sp. n. ; 83, *C. capreola* Karsch ; 84, *C. naevia* sp. n. ; 85, *C. apicalis* (Bolívar) ; 86, *C. neutralipennis* Karsch ; 87, *C. ambigua* sp. n. ; 88, *C. punctulata* (Karsch) ; 89, *C. guttatipes* Karsch ; 90, *C. occidentalis* sp. n. ; 91, *C. serrifera* sp. n. ; 92, *C. aurita* sp. n. ; 93, *C. extensipes* Karsch. The posterior end of the file is to the left in the drawings.

without basal or apical markings ; membrane blackened only in cells adjacent to $MP + Cu_{1a}$; striped pattern generated by venation, particularly marked in distal half of wings. Hind wings hyaline except for apical archedictyon. External spinules of hind femora blackened only apically.

	Females
Number of specimens examined :	2
Total length :	33·0–35·0
Median length of pronotum :	3·5–3·6
Length of hind femur :	17·3–17·8
Length of fore wing :	23·8–25·5

C. ramulosa sp. n. is very closely related to *C. nanus* sp. n., from which it can be readily distinguished by the many-branched *MA*, pectinate R_s and more conspicuous pattern of the archedictyon of the fore wings, and by the coloration of the pronotal lobes. *C. nanus* sp. n. and *C. ramulosa* sp. n. may possibly be shown by the evidence of further material to be geographic variants of the same species. However, in the absence of unequivocal evidence in this direction at the present, and since the two forms are clearly delimited in the available material, I prefer to treat them here as separate species rather than give them subspecific status.

C. ramulosa sp. n. is known only from eastern Congo (Kinshasa).

Holotype ♀. CAMEROON : 39 km S. of Walikale, 700 m, 25.xii.1957 (*Ross & Leech*) (CAS San Francisco).

Paratype ♀. CAMEROON : 39 km S. of Walikale, 700 m, 14.ix.1957 (*Ross & Leech*) (BMNH).

Catoptropteryx capreola Karsch

(Text-figs. 1, 14, 20–25, 49, 63, 66, 69, 83)

Catoptropteryx capreola Karsch, 1896 : 332. Holotype ♂, CAMEROON : Lolodorf (ZMHU Berlin) [examined].

Catoptropteryx immaculipennis Karsch, 1896 : 333. Holotype ♂, CAMEROON : Lolodorf (ZMHU Berlin) [examined]. **Syn. n.**

♂. Eyes moderately large, sub-globose, strongly prominent.

Lateral lobes of pronotum as in Text-figs. 20–25 ; height clearly exceeding length. R_s of fore wings with 2 or rarely more branches as in Text-fig. 63; R_1 bifurcate ; *MA* unbranched. Stridulatory file as in Text-fig. 83, broad, straight, teeth widely spaced. Tympanic organs without auricles.

Cerci as in Text-fig. 69 ; long and slender, circular in transverse section, arcuate, not or only very slightly sinuose viewed in plane of principal curvature ; apex acute, bearing small spinule ; length somewhat variable.

Lateral lobes of pronotum dorsad with longitudinal dark brown to black stria continuous or broken and of variable length : most common variants as in Text-figs. 20–22, 24–25 ; Text-fig. 23 illustrates rarer pattern. Fore wings without dark markings at base or apex ; membrane usually blackened for variable distance on either side of $MP + Cu_{1a}$, and occasionally over whole of cubito-anal area, but without isolated dark cells in areas *R*, R_1 or R_s. Hind wings hyaline except for apical archedictyon. External spinules of hind femora blackened only apically, as in Text-fig. 66, and not set in dark patches on femoral carina ; hind femora with numerous brown spots in distal half. Cerci, epiproct and parts of tenth abdominal tergite often red-brown or dark brown.

♀. As ♂ except for stridulatory organ and abdominal terminalia. Ovipositor as in Text-fig. 49 ; apical margin of dorsal valves smooth ; infragonangulum large, inflated, usually somewhat flattened dorsolaterally.

	Males	Females
Number of specimens examined :	184	100
Total length :	31·5–39·5	34·8–40·8
Median length of pronotum :	3·6–4·5	3·9–4·9
Length of hind femur :	15·9–21·5	17·5–20·4
Length of fore wing :	23·2–30·5	25·1–30·4
Stridulatory file—		
number examined :	17	
number of teeth (T) :	40–54	
length (replica) (F) :	1·46–1·84	
T/F :	27·4–34·4	

C. capreola Karsch has a very strong affinity with *C. naevia* sp. n., from which it is most reliably distinguished by the coloration of the external spinules of the hind femora. It also differs from that species in the coloration of the pronotal lobes, the shape of the male cerci viewed in their plane of principal curvature, and the number and distribution of teeth in the stridulatory file (see Text-fig. 1). The differences between the two species in the gonangulum of the ovipositor are not always as clear as in the specimens figured here, being of a similar magnitude to intraspecific variation and variation in distortion through drying.

The known range of *C. capreola* Karsch extends across West and Central Africa from western Liberia to Uganda and northern Angola.

Holotype ♂. Cameroon : Lolodorf (*Conradt*) (ZMHU Berlin).

Guinea : N.E. end Nimba Range, 4 mls N.W. of Nzo, vii.1963, 1 ♀ ; Nimba, Ziéla, ii.1957, 1 ♂, iii.1957, 3 ♂ ; Nimba, vii–xii.1951, 1 ♂. Liberia : Marshall Territory, iii.1955, 1 ♀, iv.1955, 1 ♀, v.1955, 2 ♂, 1 ♀, vi.1955, 3 ♂, 1 ♀, ii.1956, 1 ♀, iv.1956, 1 ♂, x.1956, 1 ♀, xii.1956, 1 ♂, iv.1957, 1 ♂ ; N. of Monrovia, Bomi Hills, 5 mls N.E. of mines, Forest Reserve Rest House, vii.1963, 3 ♂, 4 ♀. Ivory Coast : Adiopodoumé, ii.1955, 1 ♂, ix.1963, 1 ♂, x.1963, 1 ♂, vii.1965, 1 ♂, viii.1965, 1 ♂, ix.1965, 2 ♀, x.1965, 1 ♂, xi.1965, 1 ♀ ; Toumodi, Lamto, i.1952, 1 ♀, iv.1964, 8 ♂, 6 ♀, x.1966, 1 ♂, xii.1966, 2 ♂ ; Tai, i.1955, 1 ♀ ; Grabo, i.1955, 1 ♂ ; Nimba, Yalé, 380 m, iv.1964, 1 ♂ ; Forêt du Banco, x.1963, 18 ♂, 10 ♀ ; Réserve du Banco, 5 ♂, 1 ♀. Ghana : Tafo, xi.1961, 8 ♂, 3 ♀, xii.1961, 5 ♂, ii.1962, 3 ♂, iii.1962, 2 ♂, 1 ♀, iv.1957, 3 ♂, 8 ♀, v.1957, 8 ♀, vi.1957, 1 ♂, 3 ♀, v–vi.1954, 5 ♂, 2 ♀ ; W. Region, nr. Wiawso, 30 mls N.W. of Tano Lodge, x.1960, 5 ♂ ; Ashanti Region, nr. Kubease, Bobiri Forest Res., x.1960, 1 ♂, Ashanti Region, Bobiri Forest Res., 23 mls S.E. of Kumasi, xi.1959, 1 ♂ ; Ashanti Region, Bekwai Dist., Numia Forest Res., N. of Prasu R. Bridge, vii.1962, 1 ♂. Nigeria : W. Prov. 11 mls E. of Ondo, Owenna Forest Rest Ho., xii.1960, 3 ♂, 1 ♀ ; W. Prov. University Coll. Ibadan, xii.1960, 1 ♀ ; E. Prov., 20 mls N.E. of Calabar, Forest Res., i.1961, 1 ♂ ; W. Prov., 24 mls S. of Benin, Sapoba Forestry Sta., i.1961, 1 ♂ ; nr. Ibadan, Gombar, i.1965, 5 ♂, 1 ♀. Cameroon : Lolodorf (*Conradt*) 1 ♂ (ZMHU) Berlin (holotype of *Catoptropteryx immaculipennis* Karsch) ; Efulen, xi.1920, 1 ♂, vii.1922, 1 ♀, x.1922, 3 ♂, xi.1922,

14 ♂, 7 ♀, xii.1922, 12 ♂, 3 ♀, i.1923, 4 ♂, 1 ♀, ii.1923, 1 ♀, iii.1923, 6 ♂, 4 ♀, iv.1923, 1 ♂, 1 ♀ ; Kribi, 1908, 1 ♂, 1 ♀ ; Etandac, xi.1922, 1 ♂ ; Abong Mbang, x.1946, 1 ♂ ; Ja R., Bitye, 1 ♂ ; Victoria, 1 ♂ ; Kumba, vi.1959, 1 ♂ ; ————, 1950, 1 ♂ ; Mt. Cameroon, Post & Telegraph Road, 55 ft, xii.1960, 1 ♀ ; ————, 1898–1899, 1 ♀. FERNANDO PÓO : Basilé, i.1933, 1 ♂. CENTRAL AFRICAN REPUBLIC : Fort Sibut, 1375 ft, x.1934, 1 ♂. CONGO (BRAZZAVILLE) : M'boko Sogho, 1 ♀ ; Sanga R., Nola, 1300 ft, x.1934, 1 ♂, 2 ♀ ; Mayumbe, Dimonika, i.1964, 1 ♂ ; Mts. du Chaillu, Mbila, xii.1963, 4 ♂. CONGO (KINSHASA) : 39 km S. of Walikale, 700 m, ix.1957, 1 ♂, xii.1957, 1 ♂, 2 ♀ ; Ubangi, Budjalibala, ii.1949, 1 ♂ ; Région des Lacs, 1 ♂, 1 ♀ ; Flandria, xii.1930, 1 ♀ ; Equateur, Boende, vi.1926, 1 ♂ ; Equateur, Bokuma, 1951, 1 ♂ ; Idiofa, Mwilambongo, 1947, 1 ♀ ; Boma-Yanga, x.1912, 1 ♀ ; Hte Tshuapa, Skela, 1936, 1 ♀ ; Bas Congo, Luki, vi–vii.1952, 1 ♂ ; Avakubi, x.1912, 1 ♂ ; Kivu, Costermansville, 1951, 1 ♀ ; W. Kivu, Walungu, 1939, 1 ♂ ; Eala, iv–v.1932, 1 ♀ ; Kibali-Ituri Dist., 10 mls W. Epulu R. Ferry, Irumu-Avakubi Rd., Saidi, 2800 ft, ix.1934, 3 ♂, 1 ♀ ; Kibali–Ituri Dist., betw. Mambasa & Saidi, Epulu R. Ferry, 2500 ft, ix.1934, 2 ♂ ; Medje, 2°25′ N., 27°15′ E., viii.1910, 1 ♂. UGANDA : ————, 1 ♂, 1 ♀ ; Zika Forest, viii.1963, 2 ♂, x.1963, 1 ♂ ; Zika Forest, 7 mls from Entebbe, 40 ft level, iii–vi.1961, 1 ♂, 80 ft level, iii–vi.1961, 1 ♂, vii.1961, 1 ♂ ; Entebbe, x.1914, 1 ♀ ; Mfanga Forest Res., viii.1964, 1 ♀. ANGOLA : Congulu, iv.1934, 1 ♂, 1 ♀.

Catoptropteryx naevia sp. n.

(Text-figs. 1, 26–30, 50, 67, 70, 84)

♂. Eyes moderately large, sub-globose, strongly prominent.

Lateral lobes of pronotum as in Text-figs. 26–30 ; height clearly exceeding length. R_s of fore wings with 2 or rarely more branches as in Text-fig. 63 ; R_1 bifurcate ; *MA* unbranched. Stridulatory file as in Text-fig. 84, broad, slightly curved, teeth closely spaced. Tympanic organs without auricles.

Cerci as in Text-fig. 70 ; long and slender, circular in transverse section, arcuate, more or less strongly sinuose viewed in plane of principal curvature ; apex acute, bearing small spinule ; length somewhat variable.

Lateral lobes of pronotum as in Text-fig. 26, with single black spot dorsad in anterior half ; less commonly with additional dark brown to black markings in longitudinal line as in Text-figs. 27–28, and rarely as in Text-figs. 29–30, but spot corresponding in position to that in commonest variant always most conspicuous of pronotal markings. Fore wings without dark markings at base ; membrane usually blackened for variable distance on either side of $MP + Cu_{1a}$, but without isolated dark cells in areas *R*, R_1 or R_s ; small fuscous spot occasionally present at apex. Hind wings hyaline except for apical archedictyon. Some at least of external spinules of hind femora wholly black and usually set in dark brown to black patches on femoral carina, as in Text-fig. 67 ; hind femora with numerous brown spots in distal half. Cerci, epiproct and parts of tenth abdominal tergite often red-brown or dark-brown.

♀. As ♂ except for stridulatory organ and abdominal terminalia. Ovipositor as in Text-fig. 50 ; apical margin of dorsal valves smooth ; infragonangulum large, inflated, usually roughly prolate-spheroidal.

	Males	Females
Number of specimens examined :	117	32
Total length :	37·5–44·2	37·5–45·5
Median length of pronotum :	4·5–5·6	4·4–5·4
Length of hind femur :	20·1–23·2	19·1–23·5
Length of fore wing :	28·6–34·3	27·9–33·6
Stridulatory file—		
number examined :	15	
number of teeth (T) :	75–106	
length (replica) (F) :	1·66–2·18	
T/F :	39·5–54·7	

This species is very similar to *C. capreola* Karsch, from which, however, it shows a consistent distinction in the coloration of the external spinules of the hind femora, and also in the number and distribution of teeth in the stridulatory file (see Text-fig. 1). Other real though perhaps less clear-cut differences exist in the coloration of the pronotal lobes and the shape of the male cerci. The infragonangulum of the ovipositor tends to be more inflated than in *C. capreola* Karsch, but this is a rather subtle distinction that may be masked by the distortion of the basal sclerites due to drying. Although there is an overlap of the ranges of all the dimensions measured, *C. naevia* sp. n. is appreciably larger on average than *C. capreola* Karsch.

C. naevia sp. n. is distributed in West Africa from Sierra Leone to Ghana.

Holotype ♂. Liberia : Marshall Territory, 30.vii.1955 (*Fox*) (ANS Philadelphia).

Paratypes. Guinea : Forest de Diéké, 20 mls N. of Diéké, 24.vii.1963 (*Jago*) 1 ♂ (BMNH) ; Nimba, Ziéla, 25.v.1957 (*Lamotte, Amiet & Vanderplaetsen*) 1 ♂ (MNHN Paris). Sierra Leone : Kenema, 31.iii.1946 (*Jordan*) 1 ♂ (BMNH) ; Njala, 18.iv.1929 (*Hargreaves*) 1 ♀ (BMNH). Liberia : Marshall Territory, 27.xi. 1954 (*Fox*) 1 ♀ (BMNH), 27.xii.1954 (*Fox*) 1 ♀ (BMNH), 17–28.i.1955 (*Fox*) 1 ♂, 1 ♀ (BMNH), 3 ♂, 1 ♀ (ANS Philadelphia), 12–16.ii.1955 (*Fox*) 1 ♂ (BMNH), 2 ♂, 1 ♀ (ANS Philadelphia), 1–28.iii.1955 (*Fox*) 2 ♂ (BMNH), 8 ♂ (ANS Philadelphia), 19–27.iv.1955 (*Fox*) 1 ♂ (BMNH), 3 ♂ (ANS Philadelphia), 17.v.1955 (*Fox*) 1 ♂ (BMNH), 16–27.vi.1955 (*Fox*) 2 ♂ (BMNH), 3 ♂ (ANS Philadelphia), 2–30.vii.1955 (*Fox*) 2 ♂ (BMNH), 6 ♂, 1 ♀ (ANS Philadelphia), 20–28.viii.1955 (*Fox*) 1 ♂ (BMNH), 2 ♂ (ANS Philadelphia), 6–22.ix.1955 (*Fox*) 1 ♂, 1 ♀ (BMNH), 1 ♂ (ANS Philadelphia), 11–23.x.1955 (*Fox*) 1 ♂ 1 ♀ (BMNH), 4 ♂ (ANS Philadelphia), 5–16.xi.1955 (*Fox*) 1 ♂ (BMNH), 1 ♂ ,1 ♀ (ANS Philadelphia), 4–25.xii.1955 (*Fox*) 1 ♂ (BMNH), 2 ♂, 2 ♀ (ANS Philadelphia), 4–17.i.1956 (*Fox*) 1 ♂ (BMNH), 3 ♂, 1 ♀ (ANS Philadelphia), 1–18.ii.1956 (*Fox*) 2 ♂, 1 ♀ (BMNH), 6 ♂, 2 ♀ (ANS Philadelphia), 15.iii.1956 (*Fox*) 1 ♂ (BMNH), 4–25.iv.1956 (*Fox*) 1 ♂ (BMNH), 4 ♂ (ANS Philadelphia), 3–19.v.1956 (*Fox*) 1 ♂ (BMNH), 1 ♂, 1 ♀ (ANS Philadelphia), 1.vii.1956 (*Fox*) 1 ♀ (ANS Philadelphia), 28–31.x.1956 (*Fox*) 1 ♂ (BMNH), 2 ♂ (ANS Philadelphia), 7.xi.1956 (*Fox*) 1 ♂ (BMNH), 1 ♂ (ANS Philadelphia), 15.xii.1956 (*Fox*) 1 ♀ (ANS Philadelphia), 6–31.i.1957 (*Fox*) 1 ♂ (BMNH), 2 ♂ (ANS Philadelphia), 3–28.ii.1957 (*Fox*) 1 ♂ (BMNH), 2 ♂ (ANS Philadelphia), 19–21.iii.1957 (*Fox*) 1 ♂ (BMNH), 1 ♂ (ANS Philadelphia), 8.iv.1957 (*Fox*) 1 ♂ (BMNH), 1–20.v.1957 (*Fox*) 1 ♂ (BMNH), 1 ♂ (ANS Philadelphia) ; N. of Monrovia, Bomi Hills, 5 mls N.E. of mines, Forest Res.

Rest Ho., 23.vii.1963 (*Jago*) 4 ♂, 2 ♀ (BMNH) ; Bindah, forest edge, 6.iv.1920 (*Barrett*) 1 ♂ (BMNH). IVORY COAST : Adiopodoumé, 24.iii.1890 (*Vuillaume*) 1 ♀ (ORSTOM Abidjan) ; Forêt du Banco, 15.x.1963, 1 ♂ (BMNH), 1 ♂ (ORSTOM Abidjan), 12.v.1964, 1 ♂ (ORSTOM Abidjan). GHANA : Tafo, 2–30.xi.1961 (*Gardner*) 3 ♂, 1 ♀ (BMNH), 1–26.xii.1961 (*Gardner*) 1 ♂, 2 ♀ (BMNH), 1–29.i.1962 (*Gardner*) 1 ♂, 2 ♀ (BMNH), 3–25.ii.1962 (*Gardner*) 2 ♂, 3 ♀ (BMNH), 3.iii.1962 (*Gardner*) 1 ♀ (BMNH), 19.iv.1957 (*Eastop*) 1 ♀ (BMNH), 31.v.1957 (*Eastop*) 1 ♂ (BMNH), 7–21.vi. 1957 (*Eastop*) 2 ♂ (BMNH), v–vi.1954 (*Williams*) 5 ♂ (BMNH) ; Ashanti, Bobiri Forest Res., 23 mls S.E. of Kumasi, 21.xi.1959 (*Jago*) 1 ♀ (UG Accra) ; E. Region, Kade Agr. Res. Sta., 9.vii.1963 (*Acheampong*) 1 ♂ (UG Accra) ; E. Region, Tafo, W.A.C.R.I., x.1961 (*Jago*) 1 ♂ (UG Accra). GHANA ? : Fantee Country, Bosso (*Jones*) 1 ♂ (BMNH).

Catoptropteryx apicalis (Bolívar)

(Text-figs. 1, 7, 10–11, 31, 51, 71, 85. Plate 1, fig. 2)

Caedicia apicalis I. Bolívar, 1893 : 177. Holotype ♀, IVORY COAST : Assinie (IEE Madrid) [examined].

Catoptropteryx signatipennis Karsch, 1896 : 333. Lectotype ♂, CAMEROON : Victoria (ZMHU Berlin) [examined]. **Syn. n.**

Catoptropteryx apicalis (Bolívar) Kirby, 1906 : 416.

♂. Eyes moderately large, sub-globose, strongly prominent.

Lateral lobes of pronotum as in Text-fig. 31 ; height clearly exceeding length. R_s of fore wings as in Text-fig. 63, with 2 or rarely 3 branches ; R_1 bifurcate ; *MA* unbranched. Stridulatory file as in Text-fig. 85 ; broad, gently curved, teeth closely spaced. Tympanic organ without auricles.

Cerci as in Text-fig. 71 ; long, robust, arcuate, circular in transverse section, sinuose viewed in plane of principal curvature ; apex inflated behind large terminal spinule.

Lateral lobes of pronotum usually unmarked but very rarely with faint trace of longitudinal stria dorsad. Basal mark of fore wings of type shown in Text-fig. 16 : continuous black stripe about 1·0–2·5 mm long runs distad from beneath second axillary sclerite along centre of *M* ; variable number of fuscous cells on either side of $MP + Cu_{1a}$; no isolated dark cells in areas *R*, R_1 or R_s ; fuscous spot at apex usually well developed, very rarely absent. Hind wings hyaline except for apical archedictyon. Spinules of hind femora yellow or light brown at base, black at tip and set in black patches on femoral carina, or wholly black with or without dark area surrounding base. Tenth abdominal tergite, epiproct and cerci dark red or red-brown.

♀. As ♂ except for stridulatory organ and abdominal terminalia. Ovipositor as in Text-fig. 51 ; infragonangulum prominent ventrad, with well developed ventral concavity causing inferior margin of lobe to appear more or less deeply emarginate from lateral viewpoint ; apex of dorsal valves smooth.

	Males	Females
Number of specimens examined :	168	131
Total length :	41·0–46·0	44·0–50·6
Median length of pronotum :	4·5–5·0	4·8–5·7
Length of hind femur :	20·2–23·4	21·4–25·9
Length of fore wing :	30·0–33·8	32·8–36·4
Stridulatory file—		
number examined :	20	
number of teeth (T) :	79–108	
length (replica) (F) :	2·06–2·48	
T/F :	35·4–46·0	

C. apicalis (Bolívar) is very similar to *C. neutralipennis* Karsch. The males of the two species are distinguishable clearly only by the form of the apex of the cerci. Female specimens may be very difficult to distinguish and it is sometimes necessary to place some reliance on their association with identifiable males. See also discussions under *C. neutralipennis* Karsch and *C. afra* (Karsch).

The known range of *C. apicalis* (Bolívar) extends across tropical Africa from Sierra Leone to Uganda.

Lectotype Designation. Of the two syntypes of *Catoptropteryx signatipennis* Karsch, I have selected and labelled the male specimen as the LECTOTYPE.

Holotype ♀. Ivory Coast : Assinie (*Alluaud*) (IEE Madrid).

Guinea : Nimba, Ziéla, ii.1957, 1 ♂. Sierra Leone : Freetown, xi.1960, 1 ♀, xii.1966, 1 ♀. Liberia : N. of Monrovia, Bomi Hills, 5 mls N.E. of mines, Forest Reserve Rest House, vii.1963, 7 ♂, 1 ♀. Ivory Coast : Forêt du Banco, x.1963, 26 ♂, 14 ♀, v.1964, 3 ♂, 3 ♀ ; Réserve du Banco, 1 ♂ ; Mokta, vi.1964, 1 ♂ ; Adiopodoumé, v.1954, 2 ♂, iv.1955, 1 ♂, x.1963, 2 ♂, 1 ♀, xi.1963, 1 ♀, iv.1964, 1 ♀, v.1965, 5 ♂, 1 ♀, vi.1965, 1 ♂, viii.1965, 2 ♂, ix.1965, 4 ♂, 2 ♀, x.1965, 1 ♀, xi.1965, 2 ♀, i.1966, 3 ♂, 2 ♀, ii.1966, 1 ♂, xii.1966, 1 ♂ ; Lamto, Toumodi, iii.1964, 1 ♀, iv.1964, 5 ♂, 23 ♀, xii.1965, 1 ♂, 2 ♀, x.1966, 2 ♂ ; Niangon, iii.1967, 1 ♂, 1 ♀ ; Apolo Piège, v.1960, 1 ♀ ; Barrage d'Ayamé, iv.1964, 1 ♀. Ghana : Accra, xii.1963, 1 ♂ ; Kade Agr. Res. Sta., vii.1963, 3 ♂, 5 ♀ ; Kumanin, 3 mls from Kade Agr. Res. Sta., 1 ♂, 1 ♀ ; Volta Region, Amedzofe, xi.1963, 1 ♀ ; Trans-Volta Togoland, Kpandu Rest House, xii.1959, 1 ♀ ; W. Region, near Wiawso, 30 mls N.W. of Tano Lodge, x.1960, 2 ♀ ; Bibianaha, ix–xii.1909, 1 ♂ ; Tafo, v–vi.1954, 2 ♂, vi.1955, 1 ♂, iv.1957, 1 ♀, v.1957, 1 ♂, 4 ♀, vi.1957, 13 ♂, 5 ♀, xi.1961, 8 ♂, 2 ♀, xii.1961, 5 ♂, 2 ♀, i.1962, 1 ♂, 4 ♀, ii.1962, 6 ♂, 3 ♀, iii.1962, 16 ♂, 4 ♀. Nigeria : near Ibadan, Gombar, i.1965, 5 ♂, 7 ♀ ; Ibadan, x.1965, 1 ♀. Cameroon : Efulen, xi.1920, 1 ♂, 1 ♀, ix.1922, 1 ♀, x.1922, 1 ♂, 2 ♀, xi.1922, 5 ♂, 3 ♀, xii.1922, 15 ♂, 4 ♀, i.1923, 5 ♂, iii.1923, 3 ♂ iv.1923, 1 ♂, v.1923, 1 ♀ ; Etandac, xi.1922, 1 ♂ ; Victoria, Muyuka, vi.1949, 1 ♀ ; Victoria, Mabete, v–vi.1949, 1 ♀ ; Victoria (*Preuss*) 1 ♂ (lectotype of *Catoptropteryx signatipennis* Karsch) (ZMHU Berlin) ; Lolodorf (*Conradt*) 1 ♀ (paralectotype of *Catoptropteryx signatipennis* Karsch) (ZMHU Berlin) ; Jabassi, iv.1850, 1 ♀ ; Johann-Albrechtshöhe, i.1896, 1 ♀. Spanish Guinea : Rio Manyani, vi.1919, 1 ♂. Congo (Brazzaville) : Mts. du Chaillu, Mbila, xii.1963, 1 ♂, 3 ♀ ; Brazzaville, xi.1963, 2 ♀, i.1964, 1 ♂, ii.1964, 1 ♀ ; Bassin de la Sangha, 1899, 1 ♂. Congo (Kinshasa) : Kibali-Ituri Dist., 10 mls W. Epulu R. ferry, Irumu-Avakubi Rd., Saidi, ix.1934, 1 ♀ ; Congo River, left bank, Lukolela, 1°5′ S., i.1921, 1 ♀. Uganda : 7 mls from Entebbe, Zika Forest, ground level on steel tower, iii.–vi.1961, 1 ♂, 40 ft level, 1 ♂.

Catoptropteryx afra (Karsch)

(Text-figs. 17, 32)

Caedicia afra Karsch, 1889 : 446. Holotype ♀, Nigeria : Benue[1] (IZPAN Warsaw) [examined].

[1] The original description gives this locality, though the holotype itself is labelled merely ' Niger '.

Catoptropteryx afra (Karsch) Karsch, 1896 : 335 (footnote).

♂. Not known.

♀. Eyes moderately large, sub-globose, strongly prominent.

Height of lateral lobes of pronotum clearly exceeding length . R_s of fore wings bifurcate, as in Text-fig. 63 ; R_1 bifurcate ; MA unbranched. Tympanic organ without auricles.

Ovipositor not distinguishable from that of *C. neutralipennis* Karsch (Text-fig. 52) ; inferior margin of infragonangulum lobe not emarginate from lateral viewpoint ; apex of dorsal valves smooth.

Lateral lobes of pronotum without dark markings. Basal mark of fore wings of type shown in Text-fig. 17 : brown to black (in one specimen very faint, reddish) mark at base of M, about 0·4–0·8 mm long (0·4 mm in holotype), proximally not extending as far as second axillary sclerite. Cells on either side of $MP + Cu_{1a}$ darkened ; apex without dark spot. Hind wings hyaline except for apical archedictyon. Spinules of hind femora black only at tip, not set in dark patches on femoral carina.

	Holotype ♀	Other ♀♀
Number of specimens examined :	1	4
Total length :	50·3	40·2–46·2
Median length of pronotum :	6·2	4·7–5·2
Length of hind femur :	24·6	19·7–23·0
Length of fore wing :	37·4	29·5–34·1

The identity of the holotype is not at all plain. It resembles *C. apicalis* (Bolívar) in size and general appearance, but the form of the basal mechanism of the ovipositor is not distinguishable from that of *C. neutralipennis* Karsch, and in the coloration of the fore wing base it differs slightly from either of these species. *C. afra* (Karsch) is almost certainly a synonym of either *C. apicalis* (Bolívar) or *C. neutralipennis* Karsch (in fact, the last two may also prove to be one species—see discussion under *C. neutralipennis* Karsch) ; however, without males that could be confidently associated with the holotype, I have been unable to resolve the problem here. The four other females that I have included under this species agree with the holotype in the form of the ovipositor and the coloration of the fore wings and hind femora, but are considerably smaller.

C. afra (Karsch) is known only from Nigeria.

Holotype ♀. NIGERIA : Benue (IZPAN Warsaw).

NIGERIA : Ibadan, x.1956, 1 ♀, iv.1965, 1 ♀, xii.1966, 1 ♀, viii.1967, 1 ♀.

Catoptropteryx neutralipennis Karsch

(Text-figs. 1, 33, 52, 72, 86)

Catoptropteryx neutralipennis Karsch, 1896 : 334. Lectotype ♂, TOGO : Misahöhe (ZMHU Berlin) [examined].

♂. Eyes moderately large, sub-globose, strongly prominent.

Lateral lobes of pronotum as in Text-fig. 33 ; height clearly exceeding length. R_s of fore wings bifurcate as in Text-fig. 63 ; R_1 bifurcate ; MA unbranched. Stridulatory file as in Text-fig. 86 ; broad, gently curved, teeth closely spaced. Tympanic organ without auricles.

Cerci as in Text-fig. 72 ; long, slender, arcuate, circular in transverse section, more or less sinuose viewed in plane of principal curvature ; apex more or less obtuse, but without conspicuous inflation, bearing small terminal spinule.

Lateral lobes of pronotum without dark marking. Basal mark of fore wings of type shown in Text-fig. 16 : continuous black stripe, about 1·0–2·5 mm long, runs distad from beneath second axillary sclerite along centre of *M* ; variable number of fuscous cells on either side of $MP + Cu_{1a}$; no isolated dark cells in areas *R*, R_1 or R_s ; fuscous spot at apex usually poorly developed or absent, rarely well developed. Hind wings hyaline except for apical archedictyon. Spinules of hind femora black at tip only, at tip and base, or wholly black, sometimes set in dark patches on femoral carina. Cerci red- or yellow-brown.

♀. As ♂ except for stridulatory organ and abdominal terminalia. Ovipositor as in Text-fig. 52 ; inferior margin of lobe of infragonangulum not emarginate from lateral viewpoint ; apex of dorsal valves smooth.

	Males	Females
Number of specimens examined :	73	60
Total length :	37·8–43·3	37·7–44·0
Median length of pronotum :	4·1–4·9	4·3–4·8
Length of hind femur :	18·6–21·8	19·5–22·3
Length of fore wing :	27·7–31·5	28·5–31·9
Stridulatory file—		
number examined :	21	
number of teeth (T) :	64–101	
length (replica) (F) :	1·73–2·37	
T/F :	34·0–42·6	

This species can be distinguished with certainty from *C. apicalis* (Bolívar) only by the shape of the cercal apex in the male. Identification of female specimens may be impossible, for while the ovipositors of the two species may have quite different superficial appearances, their structure is essentially similar and many specimens appear intermediate when compared with the figures given here. The differences may be due to the effects of very slight differences in the relative growth rates of the basal sclerites on the manner of distortion of the integument during development. Such small differences in relative growth rates need not of course be between species, and are quite likely to be intraspecific. They are also likely to be related to the absolute dimensions of the adult insect, and since *C. apicalis* (Bolívar) is larger on average than *C. neutralipennis* Karsch, a size-related feature could falsely appear to be a specific character. There are some grounds for believing that this is probably the case here, and since the females have been segregated entirely on the appearance of the basal mechanism of the ovipositor, the division into 'species' may be in effect no more than a separation of the larger specimens from the smaller, and as such does not necessarily correspond in any way to the division between the two male forms, which is based on a discontinuity in the form of the cerci. In both sexes the two species are so similar in all other features that the possibility must be borne in mind that they and *C. afra* (Karsch) may all belong to one species, dimorphic in the male sex over part of its range, and highly variable in size. At present, however, there is not sufficient evidence to justify synonymizing the three names.

C. neutralipennis Karsch is distributed in West Africa from Sierra Leone to Cameroon.

Lectotype Designation. Of the two syntypes of *Catoptropteryx neutralipennis* Karsch, I have selected and labelled the male specimen as the LECTOTYPE.

Lectotype ♂. Togo : Misahöhe, 26.vi.1894 (*Baumann*) (ZMHU Berlin).

Paralectotype ♀. Togo : Bismarckburg, 30.x.–5.xi.1893 (*Conradt*) (ZMHU Berlin).

Guinea : Nimba, vii–xii.1951, 1 ♂ ; Nimba, Ziéla, ii.1957, 1 ♂, iii.1957, 4 ♂, 1 ♀, v.1957, 6 ♂, 2 ♀. Sierra Leone : Freetown, i.1956, 1 ♂, x.1966, 1 ♂ ; Njala, viii.1926, 1 ♂. Liberia : N. of Monrovia, Bomi Hills, 5 mls N.E. of mines, Forest Reserve Rest House, vii.1963, 3 ♂, 1 ♀ ; Marshall Territory, iii.1955, 1 ♂, iv.1955, 1 ♂, 1 ♀, v.1955, 3 ♂, 2 ♀, vi.1955, 3 ♂, vii.1955, 2 ♀, ix.1955, 3 ♂, x.1955, 2 ♀, iii.1956, 2 ♀, iv.1956, 3 ♂, 1 ♀, v.1956, 1 ♀, vi.1956, 1 ♀, i.1957, 1 ♂, iii.1957, 1 ♀. Ivory Coast : Forêt du Banco, x.1963, 1 ♂, 1 ♀ ; Lamto, Toumodi, iv.1964, 4 ♂, 2 ♀ ; Yalé, iv.1964, 1 ♂ ; Adiopodoumé, ii.1967, 1 ♀ ; Séguela, xii.1964, 1 ♀ ; Mokta, vi.1964, 1 ♀. Ghana : Trans-Volta Togoland, Kpandu, xii.1959, 1 ♂ ; E. Region, Kade Agr. Res. Sta., vii.1963, 4 ♂, 8 ♀ ; Kumanin, 3 mls from Kade Agr. Res. Sta., vii.1963, 1 ♀ ; W. Region, Sefwi-Bekwai, Shell filling sta., x.1960, 1 ♂ ; Bibianaha, ix–xii.1909, 1 ♂ ; Ashanti, near Nabaume, 6°37′N, 1°17′W, viii.1957, 1 ♀ ; Tafo, v–vi.1954, 1 ♂, 2 ♀, iv.1957, 3 ♂, 2 ♀, v.1957, 2 ♂, 7 ♀, vi.1957, 8 ♂, 9 ♀, xi.1961, 3 ♂, xii.1961, 2 ♂, 3 ♀, i.1962, 1 ♂, iii.1962, 1 ♂, 1 ♀. Nigeria : W. Province, Ibadan, xii.1960, 1 ♀ ; 24 mls S. of Benin, Sapoba Forestry Sta., i.1961, 1 ♀ ; Bende, 1 ♀. Cameroon : Efulen, xi.1922, 2 ♂, 1 ♀, iii.1923, 1 ♀.

Catoptropteryx ambigua sp. n.

(Text-figs. 1, 34–36, 53, 73, 87)

♂. Eyes moderately large, sub-globose, strongly prominent.

Lateral lobes of pronotum as in Text-figs. 34–36 ; height clearly exceeding length. R_s of fore wings as in Text-fig. 63, bifurcate ; R_1 bifurcate ; *MA* unbranched. Stridulatory file as in Text-fig. 87, narrow, almost straight, teeth closely spaced. Tympanic organs without auricles.

Cerci as in Text-fig. 73 ; moderately long, circular in transverse section, arcuate, sinuose viewed in plane of principal curvature ; apex obtuse, bearing small spinule.

Lateral lobes of pronotum dorsad with variable longitudinal stria, as in Text-figs. 35–36, black to faint red, occasionally totally absent. Basal mark of fore wings of type shown in Text-fig. 16 : continuous black stripe runs distad from beneath second axillary sclerite along centre of *M* ; broad band of fuscous cells on either side of $MP + Cu_{1a}$; no isolated dark cells in areas *R*, R_1 or R_s ; fuscous spot at apex usually very well developed, more rarely faint or absent. Hind wings hyaline except for apical archedictyon. Spinules of hind femora wholly black and set in black patches on femoral carina, as in Text-fig. 67 ; hind femora usually with numerous fuscous spots in distal half ; hind tibiae wholly dark grown to black, sometimes lighter ventrally ; hind tarsi black to very dark green. Cerci red-brown ventrally, black dorsally.

♀. As ♂ except for stridulatory organ and abdominal terminalia. Ovipositor as in Text-fig. 53 ; lobe of infragonangulum small compared with first gonocoxa ; apical margin of dorsal valves smooth.

	Males	Females
Number of specimens examined :	7	3
Total length :	35·4–38·9	37·8–40·5
Median length of pronotum :	3·7–4·3	4·3–4·7
Length of hind femur :	19·1–20·6	19·0–22·2
Length of fore wing :	25·7–28·1	27·6–30·8
Stridulatory file—		
number examined :	6	
number of teeth (T) :	63–80	
length (replica) (F) :	1·47–1·83	
T/F :	35·0–44·4	

C. ambigua sp. n. is similar in many respects to *C. neutralipennis* Karsch and to *C. punctulata* (Karsch). There is no possibility of confusion with the latter species which has a unique coloration of the fore wings. It may be distinguished from *C. neutralipennis* Karsch by the ovipositor, the coloration of the hind legs, and the pronotal stria when this is present. The ovipositor is rather similar to that of *C. nigrospinosa* (Brunner) but may be distinguished easily enough. The locality may be helpful in identifying difficult specimens (*e.g.* badly discoloured males), since the range of the species does not appear to overlap those of its most easily confused relatives.

C. ambigua sp. n. is known only from Cameroon, Congo (Kinshasa) and Uganda.

Holotype ♀. Uganda : Bwamba, Ntandi, ii.1968 (BMNH).

Paratypes. Cameroon : Ja River, Bitye, vi–vii.1909, dry season, 1 ♂ (ANS Philadelphia). Congo (Kinshasa) : Sankuru, Komi, vii.1930 (*Ghesquière*) 1 ♂ (MRAC Tervuren) ; Busira, vi.1936 (*Ghesquière*) 1 ♂ (BMNH) ; 73 mls E. of Kama, viii.1957 (*Ross & Leech*) 1 ♀ (BMNH) ; Flandria, xii.1930 (*Hulstaert*) 1 ♀ (MRAC Tervuren). Uganda :————, 1 ♂ (BMNH) ; Bwamba, Ntandi, ii.1968, 1 ♂ (BMNH) ; Bwamba, v.1956 (*Carcasson*) 1 ♂ (CM Nairobi) ; 7 mls from Entebbe, Zika Forest, lakeside swamp, 40 ft level on steel tower, iii–vi.1961 (*Corbet*) 1 ♂ (BMNH).

Catoptropteryx nigrospinosa (Brunner)

(Text-figs. 37, 54)

Caedicia nigro-spinosa Brunner, 1891 : 97. Holotype ♀, Cameroon (IZPAN Warsaw). [examined].

Catoptropteryx nigrospinosa (Brunner) Kirby, 1906 : 415.

♂. Not known.

♀. Eyes moderately large, sub-globose, strongly prominent.

Lateral lobes of pronotum as in Text-fig. 37 ; height clearly exceeding length. R_s of fore wings with 2 branches as in Text-fig. 63 ; R_1 bifurcate ; MA unbranched. Tympanic organs without auricles.

Ovipositor as in Text-fig. 54 ; apical margin of dorsal valves smooth.

Fore wings without dark markings at base ; membrane blackened for short distance on either side of $MP + Cu_{1a}$, but without isolated fuscescent cells in areas R, R_1 or R_s ; small fuscous spot at apex. Hind wings hyaline except for apical archedictyon. Spinules of hind femora wholly black and set in dark brown to black patches on femoral carina ; hind femora with numerous brown spots in distal half. Hind tibiae somewhat darkened dorsally.

	Females
Number of specimens examined :	2
Total length :	41·0–43·0
Median length of pronotum :	4·5–4·8
Length of hind femur :	20·3–20·4
Length of fore wing :	29·4–31·0

The structure of the ovipositor shows an affinity with *C. ambigua* sp. n., but the coloration of *C. nigrospinosa* (Brunner) clearly distinguishes it from all the other species of the genus.

This species is known only from Cameroon.

Holotype ♀. Cameroon (IZPAN Warsaw).

Cameroon : Efulen, 4.xii.1922, 1 ♀ (ANS Philadelphia).

Catoptropteryx punctulata (Karsch)

(Text-figs. 1, 16, 38–39, 55, 64, 74, 88)

Caedicia punctulata Karsch, 1890*a* : 260. Holotype ♀, Cameroon : Kribi (ZMHU Berlin) (in alcohol) [examined].

Catoptropteryx maculipennis Karsch, 1896 : 333. Holotype ♀, Cameroon : Lolodorf (ZMHU Berlin) [examined]. **Syn. n.**

Catoptropteryx punctulata (Karsch) Kirby, 1906 : 415.

♂. Eyes moderately large, sub-globose, strongly prominent.

Lateral lobes of pronotum as in Text-figs. 38–39 ; height clearly exceeding length. Fore wings as in Text-fig. 64 ; R_s bifurcate ; R_1 bifurcate ; *MA* unbranched. Stridulatory file as in Text-fig. 88 ; broad, curved, teeth widely spaced over three quarters of length ; in posterior quarter, file abruptly sinuose, with closely spaced teeth. Tympanic organs without auricles.

Cerci as in Text-fig. 74 ; short, arcuate, depressed in apical half, strongly sinuose viewed in plane of principal curvature ; apex acute, bearing terminal spinule.

Lateral lobes of pronotum as in Text-figs. 38–39 ; variable, continuous or broken, longitudinal brown to black stria dorsad, very rarely faint or absent. Basal mark of fore wings of type shown in Text-fig. 16 : continuous black stripe usually about 6 mm long, sometimes shorter, runs distad from beneath second axillary sclerite along centre of *M* and *MP* ; band of fuscous cells on either side of $MP + Cu_{1a}$ usually broad and giving fore wings purple-brown appearance ; in areas *R*, R_1 and R_s variable number of scattered fuscous to fuscescent cells, isolated or in small groups ; fuscous spot at apex usually very well developed. Hind wings usually faintly fumose, darker towards margin of anal fan, sometimes hyaline, except for apical archedictyon. External spinules of hind femora usually wholly black, but not set in dark patches on femoral carina. Hind tibiae dorsally more or less fuscescent, with darker area at base of each spinule ; rarely, entirely fuscous. Tenth abdominal tergite with pair of large, dark brown spots, or single median dark area ; epiproct dark brown ; cerci yellow-brown, dark brown to black dorsally.

♀. As ♂ except for stridulatory organ and abdominal terminalia. Ovipositor as in Text-fig. 55 ; first gonocoxa large, very slightly concave ; valves slender ; apex of dorsal valve smooth. Basal mark of fore wings generally shorter than in ♂, about 0·5–5·0 mm long.

	Males	Females
Number of specimens examined :	150	73
Total length :	34·3–38·5	35·8–40·8
Median length of pronotum :	4·0–4·6	4·0–4·8
Length of hind femur:	17·6–20·8	18·8–21·6
Length of fore wing :	25·5–29·6	25·8–29·7
Stridulatory file—		
number examined :	20	
number of teeth (T) :	32–43	
length (replica) (F) :	1·23–1·56	
T/F :	23·9–33·3	

This is one of the most clearly defined species in the genus, being conspicuously unique in the coloration of the fore wings, and the form of the male cerci, stridulatory file and ovipositor valves. The basal mechanism of the ovipositor is very similar to that of *C. guttatipes* Karsch, differing from this chiefly in the deeper concavity of its first gonocoxa. It is best distinguished from this species by the more slender ovipositor, the depressed cerci of the male, and the type of basal mark of the fore wings. The number and depth of colour of the dark cells of the fore wings are very variable, and the isolated spots characteristic of the species are not always easily discerned ; a piece of white paper held behind the wing is sometimes helpful in detecting these in badly faded specimens.

The known range of *C. punctulata* (Karsch) extends across tropical Africa from Sierra Leone to Uganda.

Holotype ♀. Cameroon : Kribi, xii.1888[2] (*Morgen*) (ZMHU Berlin) (in alcohol).

Guinea : Nimba, vii–xii.1951, 1 ♂, 1 ♀, 1951, 1 ♂ ; Nimba, Ziéla, ii.1957, 1 ♂, iii.1957, 6 ♂, v.1957, 7 ♂ ; Nimba, Camp Gouan, i.1957, 1 ♂ ; Nimba, Kéoulenta, xii.1956, 1 ♂. Sierra Leone : Freetown, Mt. Aureol, i.1956, 1 ♂ ; Njala, x.1928, 1 ♂, iii.1933, 1 ♂ ; Monts Loma, Forêt Camp, 1070 m, v.1963, 1 ♂. Liberia : Mt. Coffee, iii.1897, 1 ♂ ; N. of Monrovia, Bomi Hills, 5 mls N.E. of mines, Forest Reserve Rest House, vii.1963, 1 ♂ ; Marshall Territory, iii.1955, 1 ♂, iv.1955, 1 ♀, vi.1955, 1 ♂, 1 ♀, vii.1955, 3 ♂, viii.1955, 1 ♀, ix.1955, 1 ♂, i.1956, 1 ♂, ii.1956, 1 ♂, iv.1956, 3 ♀, x.1956, 1 ♂, i.1957, 1 ♂, v.1957, 1 ♂. Ivory Coast : Nimba, iv.1964, 1 ♂ ; Forêt du Banco, x.1963, 5 ♂, 3 ♀, v.1964, 1 ♂ ; Réserve du Banco, 2 ♂ ; Adiopodoumé, i.1953, 1 ♀, xii.1953, 1 ♂, iv.1955, 1 ♂, xi.1963, 1 ♂, v.1965, 2 ♂, vi.1965, 1 ♂, viii.1965, 1 ♂, x.1965, 2 ♂, iii.1967, 1 ♀ ; Lamto, Toumodi, iv.1964, 1 ♂ ; N'dzida, vi.1952, 1 ♀ ; 6 km from Tai, i.1955, 2 ♀ ; Azaguie, xi.1963, 1 ♀. Ghana : W. Region, nr. Wiawso, 3 mls N.W. of Tano Lodge, x.1960, 2 ♂ ; Ashanti, Bobiri Forest Reserve, 23 mls S.E. of Kumasi, xi.1959, 1 ♂, 1 ♀ ; nr. Kumain, Bobiri Reserve, vii.1957, 1 ♂ ; Bibianaha, ix–xii.1909, 1 ♂ ; E. Region, Kade Agr. Res. Sta., vii.1963, 1 ♂ ; Tafo, 1 ♀, v–vi.1954, 3 ♂, iv.1957, 8 ♂, 6 ♀, v.1957, 5 ♂, 8 ♀, vi.1957, 10 ♂, 11 ♀, xi.1961, 11 ♂, 6 ♀, xii.1961, 12 ♂, 1 ♀, i.1962, 4 ♂, 2 ♀, ii.1962, 11 ♂, 3 ♀, iii.1962, 2 ♂, 5 ♀. Nigeria : Oban Dist., 1 ♂ ; nr. Ibadan, Gombar,

[2] The date 23.v.1890 also appears on the label of the holotype but is clearly not the date of collection.

i.1965, 1 ♀. CAMEROON : Efulen, x.1922, 1 ♂, xi.1922, 2 ♂, xii.1922, 3 ♂, 1 ♀, i.1923, 3 ♂, iii.1923, 1 ♂, iv.1923, 1 ♂, 1 ♀ ; Douala, v.1961, 1 ♂ ; Mundame, viii.1911, 2 ♀ ; Lolodorf (*Conradt*) 1 ♀ (ZMHU Berlin) (holotype of *Catoptropteryx maculipennis* Karsch). CONGO (BRAZZAVILLE) : Oka, 1200 ft, ii.1948, 1 ♂ ; Odzala, x.1963, 1 ♂; Mayumbe, Dimonika, i.1964, 1 ♂ ; Mts. du Chaillu, Mbila, xii.1963, 1 ♂. CONGO (KINSHASA) : Eskibondo, betw. Nigangara & Dungu, Uele, 2650 ft, x.1934, 1 ♂ ; Kai Bumba, x.1920, 1 ♂ ; Région des Lacs, 1 ♂ ; 39 km S. of Walikale, 700 m, xii. 1957, 1 ♀ ; Ubangi, Budjalibala, ii.1949, 1 ♀ ; Eala, iv.1935, 1 ♀ ; Janda Sundi, x.1920, 1 ♀. UGANDA : Mpanga Forest, viii.1965, 1 ♀, x.1965, 1 ♂ ; 1 ml E. of Bundebugyo, viii.1964, 1 ♀ ; Bugoma Forest, vi.1933, 1 ♂.

Catoptropteryx guttatipes Karsch

(Text-figs. 1, 15, 40, 56, 75, 89)

Catoptropteryx guttatipes Karsch, 1890*b* : 362. Holotype ♂, CAMEROON : Barombi-Station (ZMHU Berlin) [examined].

♂. Eyes moderately large, sub-globose, strongly prominent.

Lateral lobes of pronotum as in Text-fig. 40 ; height clearly exceeding length. R_s of fore wings bifurcate as in Text-fig. 63 ; R_1 bifurcate ; MA unbranched. Stridulatory file as in Text-fig. 89 ; narrow, moderately curved, teeth widely spaced. Tympanic organs without auricles.

Cerci as in Text-fig. 75 ; short, arcuate, circular in transverse section, not depressed, strongly sinuose viewed in plane of principal curvature ; apex obtuse, bearing small spinule.

Pronotal lobes usually with no dark markings ; very rarely with very faint trace of longitudinal stria dorsad. Fore wings in region of stridulatory organ, including area M, black, red-brown or yellow-brown with black membrane ; basal mark of fore wings of type shown in Text-fig. 15 : continuous black stripe, about 1 mm long, or continuous with main dark region of area M, runs distad from beneath second axillary sclerite into area M, not along centre of M ; membrane fuscous in cells on either side of $MP + Cu_{1a}$; no isolated dark cells in areas R, R_1 or R_s ; apical fuscous spot usually small, sometimes faint or absent. Hind wings hyaline except for apical archedictyon. External spinules of hind femora usually wholly black and set in dark spots on femoral carina, less commonly not set in dark spots, rarely blackened only at tip ; hind femora rarely with one or two fuscous bands in distal half (see below). Hind tibiae dorsally usually more or less fuscous with darker spot at base of each spinule. Tenth abdominal tergite and epiproct with variable brown to black markings, former often with pair of black spots ; cerci blackened dorsally.

♀. As ♂ except for stridulatory organ and abdominal terminalia. Ovipositor as in Text-fig. 56 ; first gonocoxa large, fairly strongly concave ; apex of dorsal valves smooth. Usually no dark markings at base of fore wings except short black stripe in area M, as in Text-fig. 15 ; rarely archedictyon fuscous over whole of cubito-anal area.

	Males	Females
Number of specimens examined :	32	25
Total length :	38·6–43·7	36·7–44·1
Median length of pronotum :	4·2–4·7	4·1–4·8
Length of hind femur :	18·9–21·9	19·1–21·7
Length of fore wing :	28·6–32·5	28·6–32·4
Stridulatory file—		
number examined :	30	
number of teeth (T) :	33–82	
length (replica) (F) :	1·40–2·11	
T/F :	21·6–39·4	

The ovipositor of this species is extremely similar to that of *C. punctulata* (Karsch), differing chiefly in its more strongly concave first gonocoxa and much less slender valves. Male specimens could be confused with *C. occidentalis* sp. n. and may best be distinguished by their shorter, more strongly sinuose cerci. Two male specimens from Congo (Kinshasa) and one female from Cameroon have two conspicuous fuscous bands, one apical, in the distal half of the hind femora. The males are set apart from the rest of the material examined also by the high number of teeth (79 and 82) in the stridulatory file. These two males are linked tenuously to the other 27 examined, among which the highest tooth number recorded was 55, by one specimen with 63 stridulatory teeth (see Text-fig. 1), and with no trace of dark bands on the hind femora. None of these unusual individuals differs sufficiently from the other material in any other characters to be considered specifically distinct, and the variation seems to have no broad geographic significance, so no formal nomenclatural recognition is indicated.

C. guttatipes Karsch appears to be sparsely distributed in Central Africa from eastern Nigeria to Uganda, but is also recorded here from two localities in southern Guinea.

Holotype ♂. CAMEROON : Barombi-Station (*Preuss*) (ZMHU Berlin).

GUINEA : W. of Irié, Col de Seredou, vii.1963, 1 ♂ ; Nimba, vii–xii.1951, 1 ♀. NIGERIA : Eastern Prov., 20 mls N.E. of Calabar, Forest Reserve, i.1961, 1 ♂. CAMEROON : ————, 3 ♂, 1 ♀ ; Johann-Albrechtshöhe, iv.1896, 1 ♂, viii.1896, 1 ♀ ; Tiko Pl., Matute, v.1949, 1 ♂ ; Mundame, 1 ♀ ; Kumba, xi.1938, 1 ♀, vi.1959, 1 ♀ ; Ja River, Bitye, 2 ♀, vi–vii.1909, dry season, 1 ♂, 1 ♀ ; Victoria, 4 ♀ ; Efulen, ix.1922, 1 ♂, xi.1922, 4 ♂, xii.1922, 1 ♂, 4 ♀, i.1923, 2 ♂, ii.1923, 1 ♂. CONGO (BRAZZAVILLE) : Sanga R., Nola, 1300 ft, x.1934, 1 ♂ ; Mts. du Chaillu, Mbila, xii.1963, 2 ♂, 1 ♀ ; Odzala, x.1963, 1 ♂. CONGO (KINSHASA) : 39 km S. of Walikale, ix.1957, 1 ♂ ; Ituri Forest, 4000 ft, iv.1930, 1 ♂ ; Bangala, Loka, xii.1931, 1 ♂ ; Kivu, Costermansville, 1951, 1 ♂ ; Mayumbe, Makungu, xi.1912, 1 ♂ ; Tshuapa, Flandria, xi.1940, 1 ♂ ; Yambata, ii–iii.1914, 1 ♀ ; Libenge, i.1937, 1 ♀ ; Stanleyville, vii.1912, 1 ♀ ; Binga, iii.1932, 1 ♀ ; Kibali-Ituri Dist., Irumu-Avakubi Rd., 10 mls W. Epulu R. ferry, Saidi, 2800 ft, ix.1934, 1 ♀.

Catoptropteryx occidentalis sp. n.

(Text-figs. 1, 41, 57, 76, 90)

♂. Eyes moderately large, sub-globose, strongly prominent.

Lateral lobes of pronotum as in Text-fig. 41 ; height clearly exceeding length. R_s of fore wings bifurcate as in Text-fig. 63 ; R_1 bifurcate ; *MA* unbranched. Stridulatory file as in Text-fig. 90, broad, moderately curved, teeth widely spaced. Tympanic organs without auricles.

Cerci as in Text-fig. 76 ; long and slender, circular in transverse section, arcuate, somewhat sinuose viewed in plane of principal curvature ; terminating in small spinule.

Fore wings in region of stridulatory organ, including area *M*, red-brown to yellow-brown with black membrane and sometimes black Cu_2 ; basal mark of fore wings of type shown in Text-fig. 15 : continuous black stripe, about 1·5 mm long, runs distad from second axillary sclerite

into area *M*, not along centre of *M* ; membrane fuscous in cells on either side of $MP + Cu_{1a}$; no isolated dark cells in areas *R*, R_1 or R_s ; fuscous or fuscescent spot, usually well developed, at apex. Hind wings hyaline except for apical archedictyon. External spinules of hind femora usually wholly black, sometimes also set in dark patches on femoral carina. Hind tibiae dorsally more or less fuscescent, with darker area at base of each spinule. Tenth abdominal tergite, epiproct and cerci red-brown ; cerci blackened dorsally in proximal half.

♀. As ♂ except for stridulatory organ and abdominal terminalia. Ovipositor as in Text-fig. 57 ; form of basal mechanism highly distinctive : first gonocoxa very large, with ventro-posterior angle about 90° containing small, deep depression ; second gonocoxa particularly prominent ; apical margin of dorsal valves smooth. No dark coloration at base of fore wings except basal stripe in area *M*.

	Males	Females
Number of specimens examined :	4	5
Total length :	41·8–43·8	40·9–42·8
Median length of pronotum :	4·8–5·0	4·7–5·0
Length of hind femur :	21·0–21·7	20·0–21·4
Length of fore wing :	31·2–32·7	30·7–32·3
Stridulatory file—		
number examined :	4	
number of teeth (T) :	41–46	
length (replica) (F) :	1·73–1·98	
T/F :	22·2–26·6	

C. occidentalis sp. n. is nearest morphologically to *C. guttatipes* Karsch with which the males could sometimes be confused ; the cerci, however, are usually much longer and rather less sinuose than in the latter species. The females are easily distinguished by the form of the basal mechanism of the ovipositor, which is quite unlike that of any other species.

This species is known only from Liberia and Ivory Coast.

Holotype ♀. Liberia : N. of Monrovia, Bomi Hills, 5 mls N.E. of mines, Forest Reserve Rest House, 23.vii.1963 (*Jago*) (BMNH).

Paratypes. Ivory Coast : Forêt du Banco, 15.x.1963, 2 ♂, 1 ♀ (BMNH), 1 ♂ (ORSTOM Abidjan), 12.v.1964, 1 ♂ (ORSTOM Abidjan) ; Tai, 21.i.1955, 1 ♀ (ORSTOM Abidjan) ; Forêt sud, Ndzida, 31.v.1952, 1 ♀ (ORSTOM Abidjan) ; ————, 6.ii.1960 (*Cachan*) 1 ♀ (ORSTOM Abidjan).

Catoptropteryx serrifera sp. n.

(Text-figs. 1, 42, 58, 77, 91, 94–95)

♂. Eyes moderately large, sub-globose, strongly prominent.

Lateral lobes of pronotum as in Text-fig. 42 ; length usually about equal to, or slightly exceeding height ; rarely length very slightly less than height. R_s of fore wings with 2 or rarely 3 branches as in Text-fig. 63 ; R_1 bifurcate ; *MA* unbranched. Stridulatory file as in Text-fig. 91, usually almost straight, teeth closely spaced. Tympanic organ without auricles.

Cerci as in Text-fig. 77 ; short, arcuate, circular in transverse section, more or less sinuose viewed in plane of principal curvature ; terminating in small spinule which is sometimes unguiform.

No dark markings apart from blackened tips of spurs and spinules. External spinules of hind femora black or dark brown apically, or wholly so, but with no dark area around their bases. Hind wings hyaline except for apical archedictyon.

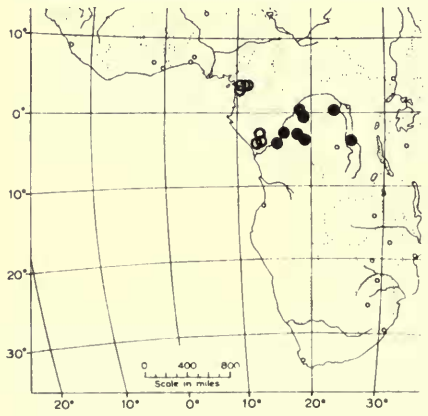
♀. As ♂ except for stridulatory organ and abdominal terminalia. Ovipositor as in Text-fig. 58 ; apex of dorsal valve crenulate, bearing about 4–5 very small irregular teeth.

	Males	Females
Number of specimens examined :	13	16
Total length :	40·3–47·3	40·5–45·0
Median length of pronotum :	4·6–5·6	4·7–4·5
Length of hind femur :	21·2–22·9	20·6–23·5
Length of fore wing :	30·5–36·2	31·4–35·4
Stridulatory file—		
number examined :	13	
number of teeth (T) :	58–77	
length (replica) (F) :	1·55–2·05	
T/F :	33·2–47·4	

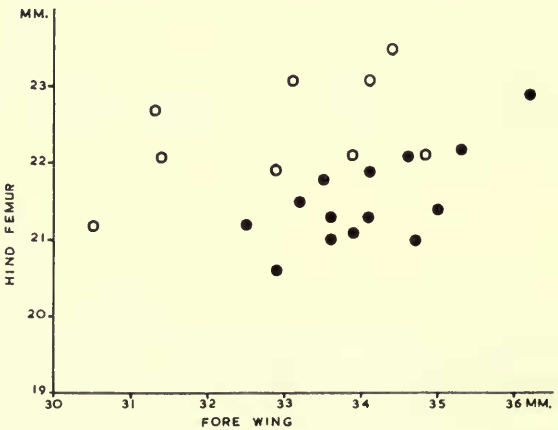
The form of the lateral lobes of the pronotum, the absence of black markings from the pronotum and from the base of the fore wings, and the absence of tympanic auricles, taken in combination distinguish this species from its congeners. The female is additionally characterized by the distinctive, though somewhat variable, form of the basal sclerites of the ovipositor, and its toothed dorsal valves.

This species presents a morphological link between the typical species of the genus and the East African species with its tympanic auricles, its affinity with the latter species being manifest in the toothed ovipositor, the form of the basal sclerites and the shape of the pronotal lobes.

When the material from north of the Congo River is compared with that from the south side, differences in dimensions, and subtle differences in the ovipositors, are apparent. In the southern group the apical teeth of the ovipositor are bigger, the appearance of the basal sclerites is somewhat different and the length of the fore wings relative to that of the hind femora is less (see Text-fig. 95). It would not be



94



95

FIGS. 94–95. *Catoptropteryx serrifera* sp. n. : 94, map showing the distribution ; 95, scatter diagram of length of hind femur plotted against length of fore wing. Black disks represent specimens from south, open circles specimens from north, of the Congo River.

unreasonable to suppose that the Congo River might sufficiently restrict gene-flow between the northern and southern populations for stable subspecific distinctness of the two groups to be maintained. Carcasson (1964) stated : ' Very often the ranges of two vicariants will be separated by a partial geographic barrier which may not have been the cause of the original disjunction, but may help to stabilize their respective ranges . . . The Congo River and the Rift Valleys of East Africa are also important dividing lines, though not necessarily effective barriers '. In the present case, however, I consider there is not sufficient justification for introducing subspecific names into nomenclature, and any conclusions based on the morphological discontinuity between the groups must have regard to the small number of specimens examined.

C. serrifera sp. n. is known only from the lowland forest zone of Central Africa (Text-fig. 94).

Holotype ♀. Cameroon : Efulen, 10.xi.1922 (*Weber*) (ANS Philadelphia).

Paratypes. Cameroon ? :————, 23.v.1890 (*Morgen*) 1 ♂ (ZMHU Berlin) (in alcohol). Cameroon : Metet, 21.iii.1942, 1 ♂ (ANS Philadelphia) ; Sangamelima, Fulasi, v.1920 (*Evans*) 1 ♂ (MZUM Ann Arbor) ; Lolodorf, 21.i.1919 (*Reis*) 1 ♂ (MZUM Ann Arbor) ; Efulen, 16.xi.1922 (*Weber*) 1 ♂ (ANS Philadelphia), 4–23.xii. 1922 (*Weber*) 2 ♂, 1 ♀ (ANS Philadelphia), 1 ♂ (BMNH), 15.i.1923 (*Weber*) 1 ♀ (BMNH). Congo (Brazzaville) : Chaillu Mts., Mbila, xii.1963 (*Descarpentries & Villiers*) 2 ♂, 1 ♀ (MNHN Paris), 1 ♂ (BMNH) ; Sibiti, xi.1963 (*Descarpentries & Villiers*) 1 ♀ (MNHN Paris), 1 ♀ (BMNH) ; Mayumbe, Dimonika, i.1964 (*Descarpentries & Villiers*) 1 ♀ (MNHN Paris). Congo (Kinshasa) : Simba, x.1912 (*Mayné*) 1 ♂ (MRAC Tervuren) ; Lac Leopold II, Bolobo, 1955 (*Viccars*) 1 ♂ (BMNH) ; Equateur, Flandria, 1929 (*Hulstaert*) 2 ♀ (MRAC Tervuren) ; Oshwe, xii.1913 (*Maes*) 1 ♀ (MRAC Tervuren) ; Stanley Pool, 3–10.x.1957 (*Brien, Poll & Bouillon*) 1 ♀ (MRAC Tervuren) ; N'Kele, Kunungu, 1937 (*Schouteden*) 1 ♀ (MRAC Tervuren) ; Maniema, 1936 (*Henrard*) 1 ♀ (MRAC Tervuren) ; Tolo, xii.1913 (*Maes*) 1 ♀ (BMNH) ; Eala, xi.1934 (*Ghesquière*) 1 ♀ (BMNH) ; Equateur, Bokuma, 30.viii.1934 (*Hulstaert*) 1 ♀ (BMNH).

Catoptropteryx aurita sp. n.

(Text-figs. 1, 4, 12–13, 43–45, 59, 78, 92. Plate 1, fig. 3)

♂. Eyes moderately large, sub-globose, strongly prominent.

Lateral lobes of pronotum as in Text-figs. 43–45 ; approximately as high as long. R_s of fore wings as in Text-fig. 63, bifurcate, or rarely with 3 or 4 dichotomous branches ; R_1 with 2 or 3 branches ; *MA* unbranched. Stridulatory file as in Text-fig. 92 ; narrow, moderately curved, teeth widely spaced. Tympanic organs as in Text-figs. 12–13 ; internal side with auricle more or less well developed.

Cerci as in Text-fig. 78 ; short, circular in transverse section, arcuate, somewhat sinuose viewed in plane of principal curvature ; terminating acutely in small spinule. Styles comparatively large, with clear articulation with subgenital plate.

Lateral lobes of pronotum without dark marking or with partially developed black stria dorsad, as in Text-figs. 43–45. Fore wings without dark markings at base ; large fuscescent spot at apex ; membrane dark in cells adjacent to $MP + Cu_{1a}$, but no isolated dark cells in

areas R, R_1 or R_5. Hind wings hyaline except for apical archedictyon. Spinules of hind femora apically or wholly black.

♀. As ♂ except for stridulatory organ and abdominal terminalia. Ovipositor as in Text-fig. 59 ; apex of dorsal valves serrate, bearing about 5–7 small teeth.

	Males	Females
Number of specimens examined :	10	10
Total length :	41·3–54·3	40·5–52·2
Median length of pronotum :	5·5–6·2	5·2–5·9
Length of hind femur :	21·4–25·5	20·7–26·0
Length of fore wing :	29·8–40·1	31·1–45·7
Stridulatory file—		
number examined :	10	
number of teeth (T) :	41–53	
length (replica) (F) :	1·68–2·21	
T/F :	23·5–26·5	

C. aurita sp. n. is very clearly distinct from the rest of the genus, having a rudimentary to quite well developed auricle on the internal side of the tympanic organ. The distribution has no intersection with that of any other species. *C. serrifera* sp. n. provides a geographical and morphological bridge from this to the typical species, having the unusual form of the pronotal lobe in common with *C. aurita* sp. n., an ovipositor in many respects intermediate, and a tympanic organ of the typical form. In *C. aurita* sp. n. the teeth of the ovipositor are larger and more regular in shape than in *C. serrifera* sp. n., and the form of the basal mechanism, though similar, can be distinguished easily enough ; however, the best distinguishing feature of specimens with poorly developed tympanic auricles is the number of teeth in the stridulatory file. The variations in coloration, size, and form of ovipositor and tympanic organ have no apparent geographic correlations.

C. aurita sp. n. is known only from East Africa, ranging from southern Kenya to southern Rhodesia and Mozambique (Text-fig. 4).

Holotype ♀. Rhodesia : Lundi, 3–5.iii.1964 (*van Son & Vári*) (TM Pretoria).

Paratypes. Kenya : Mombasa, iv.1955, 1 ♀ (BMNH). Tanzania : E. Usambara Mts., Amani, 1950 (*Verdcourt*) 1 ♀ (CM Nairobi) ; Zanzibar, Mtoni, v.1954 (*Brown*) 1 ♂ (BMNH). Zambia : Abercorn, 18–22.xi.1963 (*Vesey-Fitzgerald*) 1 ♂ (BMNH); ————(*Trenewith*) 1 ♀ (TM Pretoria). Rhodesia : Lundi, 3–5.iii.1964 (*van Son & Vári*) 1 ♂, 1 ♀ (BMNH), 3 ♂ (TM Pretoria) ; Vumba, 2–9.xi.1959 (*van Son*) 1 ♂ (BMNH) ; S. Melsetter, Vimba, x.1955, 1 ♀ (NM Bulawayo). Mozambique : Kruger National Park, Pafuri, 24–28.iv.1961 (*Rorke*) 1 ♀ (TM Pretoria) ; Chiluvo Hills, x.1963 ,1 ♂ (BMNH), 3.xi.1963, 2 ♂, 2 ♀ (NM Bulawayo) ; Savanie Forest, x. 1963, 1 ♀ (NM Bulawayo).

Catoptropteryx extensipes Karsch

(Text-figs. 1, 5–6, 8–9, 46–47, 65, 79–81, 93)

Catoptropteryx extensipes Karsch, 1896 : 334. Holotype ♂, Cameroon : Lolodorf (ZMHU Berlin) [examined].

♂. Eyes as in Text-figs. 5–6, 8–9 ; very large, elliptic, moderately, rarely strongly, prominent.

Lateral lobes of pronotum as in Text-figs. 46–47 ; height slightly greater than length. Fore wings as in Text-fig. 65 ; appreciably narrowed in distal half ; R_s bifurcate ; R_1 with 2 to 4 branches ; *MA* unbranched. Stridulatory file as in Text-fig. 93 ; broad, moderately curved, teeth widely spaced. Tympanic organs without auricles.

Cerci as in Text-figs. 79–81 ; strongly arcuate to U-shaped, near apex abruptly narrowed and bent downward slightly ; apex acute.

General coloration green. Frons, labrum and clypeus suffused with brown of variable intensity. Pronotal lobes unmarked, or with longitudinal brown to black stria dorsad as in Text-fig. 47, not extending as far as anterior margin. Basal mark of fore wings similar to type shown in Text-fig. 16 but very reduced in length and width, about 0·5 mm long ; cells in posterior half of wing fuscescent but not distributed in isolated groups in areas *R*, R_1 or R_5. Hind wings somewhat fumose, darker toward margin of anal fan. Herring-bone pattern of hind femora picked out in dark brown. Hind tibiae deep brown, paler or more reddish dorsally, with 2 broad, well defined, very pale yellow or green bands in proximal third. Tarsi and apex of tibiae almost black, with some small paler markings. Abdominal tergites with fuscous spot dorsally, tenth with broad fuscous or black patch ; epiproct and paraprocts dorsally with variable brown to black markings ; cerci wholly black.

♀. Not known.

	Males
Number of specimens examined :	11
Total length :	44·6–50·8
Median length of pronotum :	5·3–6·3
Length of hind femur :	25·7–30·0
Length of fore wing :	31·9–36·9
Stridulatory file—	
number examined :	11
number of teeth (T) :	49–79
length (replica) (F) :	2·07–2·71
T/F :	20·5–35·3

This species differs from the rest of the genus in so many characters, the most striking of which are the form of the eyes, cercus and fore wings, that one may suspect that the discovery of the female could make the erection of a new genus desirable for it. As it is, without the evidence of the female, and more particularly of the structure of the ovipositor, the species rests not too uncomfortably in *Catoptropteryx* Karsch, and it is most conveniently left here for the time being. There is some geographic variation in the pronotal coloration and the form of the cerci and eyes. At the western and eastern edges of the range the pronotal stria is absent, and in specimens from Cameroon and Fernando Póo the eyes are narrower (Text-figs. 5 and 8) and the cerci less strongly curved (Text-fig. 79).

Catoptropteryx extensipes Karsch has a West African distribution, ranging from Sierra Leone to Cameroon and Fernando Póo.

Holotype ♂. CAMEROON : Lolodorf (*Conradt*) (ZMHU Berlin).

GUINEA : Nimba, Ziéla, iii.1957, 3 ♂. SIERRA LEONE : Freetown, Mt. Aureol, vi.1956, 1 ♂. LIBERIA : N. of Monrovia, Bomi Hills, 5 mls N.E. of mines, Forest Reserve Rest House, vii.1963, 1 ♂. IVORY COAST : Forêt du Banco, x.1963, 1 ♂. GHANA : W. Region, near Wiawso, 3 mls N.W. of Tano Lodge, x.1960, 1 ♂. CAMEROON : Efulen, xi.1920, 1 ♂, xii.1922, 1 ♂. FERNANDO PÓO : 1901, 1 ♂.

REFERENCES

Bolívar, I. 1893. Voyage de M. Ch. Alluaud dans le territoire d'Assinie (Afrique occidentale) en juillet et août 1886. 14e Mémoire. Orthoptères. *Annls Soc. ent. Fr.* **62** : 169–184, 1 pl.

Brunner von Wattenwyl, C. 1891. Additamenta zur Monographie der Phaneropteriden. *Verh. zool.-bot. Ges. Wien* **41** : 1–196, 2 pls.

Carcasson, R. H. 1964. A preliminary survey of the zoogeography of African butterflies. *E. Afr. Wildl. J.* **2** : 122–157, 6 figs.

Chopard, L. 1955. *In* Hanström, B., Brinck, P. & Rudebeck, G. [Edd.], *S. Afr. Anim. Life* **2** : 266–300 (Orthoptera Ensifera), 26 figs. Stockholm.

Karsch, F. 1889. Orthopterologische Beiträge III. *Berl. ent. Z.* **32** : 415–464, 1 pl.

—— 1890*a*. Neue westafrikanische durch Herrn Premierlieutenant Morgen von Kribi eingesendete Orthopteren. *Ent. Nachr.* **16** : 257–276, 4 figs.

—— 1890*b*. Verzeichniss der von Herrn Dr. Paul Preuss auf der Barombi-Station in Deutsch-Westafrika, 1890, gesammelten Locustodeen aus den Familien der Phaneropteriden, Mekonemiden und Gryllakriden. *Ent. Nachr.* **16** : 353–369, 4 figs.

—— 1896. Neue Orthopteren aus dem tropischen Afrika. *Stettin. ent. Ztg* **57** : 242–359, 44 figs.

Kirby, W. F. 1906. *A synonymic catalogue of Orthoptera* **2,** Pt. 1, viii + 562 pp. London.

Ragge, D. R. 1955. *The wing-venation of the Orthoptera Saltatoria* 159 pp., 106 figs. London.

—— 1964. A revision of the genus *Tylopsis* Fieber (Orthoptera : Tettigoniidae). *Bull. Br. Mus. nat. Hist.* (Ent.) **15** : 297–322, 52 figs.

—— 1969. A revision of the African species of *Pseudorhynchus* Serville (Orthoptera : Tettigoniidae). *Bull. Br. Mus. nat. Hist.* (Ent.) **23** : 167–190, 38 figs.

Scudder, G. G. E. 1961*a*. The comparative morphology of the insect ovipositor. *Trans. R. ent. Soc. Lond.* **113** : 25–40, 10 figs.

—— 1961*b*. The functional morphology and interpretation of the insect ovipositor. *Can. Ent.* **93** : 267–272, 5 figs.

—— 1964. Further problems in the interpretation and homology of the insect ovipositor. *Can. Ent.* **96** : 405–417, 11 figs.

Walker, F. 1869. *Catalogue of the specimens of Dermaptera Saltatoria in the collection of the British Museum* **2** : 225–423. London.

John Huxley
Department of Entomology
British Museum (Natural History)
Cromwell Road
London, S.W.7